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BULLETINS

OF

AMERICAN

PALEONTOLOGY

18

Vol. I

May 25, 1895—December 7, 1896

Cornell Univ., Ithaca, N. Y.
Harris Company.

Smithsonian Institution
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Vol. 1

BULLETINS
OF
AMERICAN PALEONTOLOGY

No. 1

CLAIBORNE FOSSILS

BY

G. D. HARRIS

May 25, 1895

Cornell Univ., Ithaca, N. Y.
Harris & Stoneman

Smithsonian Institution,
JAN 19 1910
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CLAIBORNE FOSSILS

By

Gilbert D. Harris.

Part I.—Synonymy of the Claiborne sand species of Conrad and Lea as determined by an inspection of the type collections now at the Academy of Natural Sciences of Philadelphia.

To some, perhaps a discussion of this subject will appear unnecessary at the present time since Conrad formerly wrote two articles covering practically the same grounds, the first in an appendix to Morton's Synopsis of Organic Remains &c., 1834, the second in volume 1 of the American Journal of Conchology, 1865. From these articles however, as well as the personal relations that existed between himself and Lea, it is evident he did not have access to the latter's collections, and the deductions he was able to draw regarding them from the Contributions to Geology were not always trustworthy.

Of late, two foreign paleontologists, viz., de Gregorio of Palermo and M. Cossmann of Paris have given us the benefit of their studies on the Alabama Eocene fauna in the *Annales de Géologie et de Paléontologie*, 1890–93. But their work while showing much study is sometimes at fault and it might be said unpardonably so if they had had access to one or both type collections. De Gregorio's work is very elaborate and in many ways remarkable. Though it claims to be an exhaustive treatise on the subject, American Tertiary paleontologists will agree that a good monograph on the Claiborne molluscan fauna has still to be written. As a slight aid to those who may be striving toward that end this table of synonymy has been prepared.

The Conradian collection is fairly complete as regards its larger species but many of the smaller ones, especially the *Fusi*, appear to be lost. The Lea collection (here made to include that of H. C. Lea also) contains a number of small species differing slightly from each other. Their relations will only be determined by collecting immense numbers of allied forms and comparing the same with the so-called types.

In both collections some of the specimens have been glued on the wrong card; in some instances species of different families are assembled and made fast to one and the same card. Under these circumstances it is evident that some of the conclusions herein expressed may be changed by future research, yet it is believed that with nearly all the type specimens of both collections before one and with complete copies of both Lea's and Conrad's works in hand, the conclusions that one can draw on matters of synonymy should be more trustworthy than those based on literature or on literature and one type collection.

It will be observed that no attempt is here made to rectify generic references. But what species of the Conrad and Lea collections are in the Academy; the names (generic and specific) first applied to them; their equivalency—these are the facts intended to be brought out by the following list.

aciculata Lea

Pasithea aciculata Lea, Cont. to Geol., 1833, p. 102, pl. 4, fig. 82.

acutirostra Con.

Pleurotoma acutirostra Con., Foss. Sh. Tert. Form., 1835, p. 52, pl. 17, fig. 21.
See *Pl. childreni* Lea.

acutus Lea

Fusus acutus Lea, Cont. to Geol., Dec., 1833, p. 149, pl. 5, f. 153.
Syn. of *F. limulus* Con., which see.

æqualis Con.

Nucula æqualis Con. equals *N. equalis* Con., which see.

æquorea Con.

Cytherea æquorea Con., Foss. Sh. Tert. Form., Sept., 1833, p. 36; pl. 20, fig. 5 of Harris's republication.
Cytherea hydii Lea, Cont. to Geol., Dec., 1833, p. 66, pl. 2, f. 42.

æquorea Con.

Erycina æquorea Con., Foss. Sh. Tert. Form., Nov., 1833, p. 42; pl. 19, fig. 11 of Harris's republication.
Mactra grayi Lea, Cont. to Geol., Dec., 1833, p. 42, pl. 1, fig. 10.
Mactra æquorea Con.
Conrad's type specimen is lost.

ætites Con.

Natica ætites Con., Foss. Sh. Tert. Form., Nov., 1833, p. 46.
Natica mamma Lea, Cont. to Geol., Dec., 1833, p. 109, pl. 4, fig. 95.
Neverita ætites Con., Amer. Jr. Conch., 1865, p. 27.
Conrad's description of this form is so imperfect that Lea's name although published a month subsequent should hold.

alabamiensis Lea

Corbula alabamiensis Lea, Cont. to Geol., Dec., 1833, p. 45, pl. 1, fig. 12.

Corbula nasuta Con., Foss. Sh. Tert. Form., Sept., 1833, p. 38; pl. 19, fig. 4 of Harris's republication.

The name *C. nasuta* having been preoccupied by Sowerby, Lea's *C. alabamiensis* will stand.

alabamiensis Lea

Monoptygma alabamiensis Lea, Cont. to Geol., p. 186, pl. 6, fig. 201. Young of *Ancillaria lymneoides*, which see.

alabamensis Con.

Oliva alabamensis Con., Foss. Sh. Tert. Form., No. 3, Sept., 1833, p. 32; pl. 16, fig. 3 of 2d ed., 1835.

Oliva greenoughi Lea, Cont. to Geol., Dec., 1833, p. 183, pl. 6, fig. 197.

Oliva dubia Lea, " " " " fig. 198.

Oliva phillipsii Lea " " " p. 184, pl. 6, fig. 199; this is a small short form.

Oliva gracilis Lea, Cont. to Geol., Dec., 1833, p. 182, pl. 6, fig. 196; this is a very small and slender form.

Conoliva alabamensis Con.

alabamiensis Lea

Ostrea alabamiensis Lea, Cont. to Geol., Dec., 1833, p. 91, pl. 3, fig. 71.

Ostrea semilunata Lea, " " " p. 90, pl. 3, fig. 69.

Ostrea pincerna Lea, " " " p. 92, pl. 3, fig. 73.

Ostrea lingula canis Lea, " " " p. 92, pl. 3, fig. 72.

Ostrea claibornensis Con. MS. label in Phila. Ac. Coll.

Conrad's specimens are full grown while Lea's are all young. In Lea's book the name *O. semilunata* occurs one page earlier than *O. alabamiensis* and hence might be used in preference to the latter; yet it is applied to a distorted specimen and besides, *O. alabamiensis* is now in common use. The type specimen is not so thick as Lea's figure indicates. This species is remarkable for its horn-like epidermal coating marked by fine radiating striæ.

alta Con.

Crassatella alta Con., Foss. Sh. Tert. Form., No. 2, 1832, p. 21, pl. 7; also Am. Jr. Sci., vol. 1, 1846, p. 395, pl. 3, fig. 1.

alta Con.

Tellina alta Con., Foss. Sh. Tert. Form., No. 4, Nov., 1833, p. 41.

alternatum Lea

Dentalium alternatum Lea, Cont. to Geol., Dec., 1833, p. 34, pl. 1, fig. 2.

A synonym of *D. thalloides*, which see.

alternata Lea

Murex alternata Lea, Cont. to Geol., Dec., 1833, p. 157, pl. 5, fig. 163.

Syn. of *Typhis gracilis* Con.

alternata Con.

Pleurotoma alternata Con., Foss. Sh. Tert. Form., Nov., 1833, p. 46. *Idem* 2d edition, 1835, p. 50, pl. 17, fig. 13.

See *P. lesueurii* Lea.

alternata Lea

Tuba alternata Lea, Cont. to Geol., Dec., 1833, p. 128, pl. 4, fig. 118.

Synonym of *Littorina antiquata* Con., which see.

alticostata Con.

Cardita alticostata Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 342.

Venericardia transversa Lea, Cont. to Geol., Dec., 1833, p. 68, pl. 2, fig. 46.

V. sillimani Lea, *ibid.*, p. 69, pl. 2, fig. 47.

altile Con.

Ancillaria altile Con., Foss. Sh. Tert. Form., 1832, p. 24, pl. 10, fig. 2.

Anolax gigantea Lea, Cont. to Geol., 1833, p. 180, pl. 6, f. 193.

altilis Con.

Fusus altilis Con., Foss. Sh. Tert. Form., 1833, p. 43; 2d ed, pl. 18, fig. 16.

Papillina altilis Con., Am. Jr. Conch., vol. 1, 1865, p. 17.

alveata Con.

Cancellaria alveata Con., Foss. Sh. Tert. Form., Nov., 1833, p. 45; pl. 16, fig. 19 of the second edition.

C. sculptura Lea, Cont. to Geol., Dec., 1833, p. 140, pl. 5, f. 137.

alveata Con.

Lucina alveata Con., Foss. Sh. Tert. Form., Nov., 1833, p. 40.

L. lunata Lea, Cont. to Geol., Dec., 1833, p. 58, pl. 1, fig. 32.

alveata Con.

Melongena alveata Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 344.
Pyrula smithii Lea, Cont. to Geol., Dec., 1833, p. 155, pl. 5, fig. 162.
Melongena alveata Con., 2d ed. of Foss. Sh. etc , 1835, p. 37, pl. 15, fig. 2.
Lacinia alveata Con., Proc. Acad. Nat. Sci., 1853, p. 448.

alveatum Con.

Solarium alveatum Con., Foss. Sh. Tert. Form., Sept., 1833, p. 31.
S. bilineatum Lea, Cont. to Geol., Dec., 1833, p. 119, pl. 4, fig. 106.
S. alveatum Con., Foss. Sh. etc., 2d ed., 1835, p. 47, pl. 17, f. 3.
Architectonica alveata Con.

amœnum Con.

Buccinum amœnum Con., Foss. Sh. Tert. Form., Nov., 1833, p. 45.
Terebra gracilis Lea, Cont. to Geol., Dec., 1833, p. 166, pl. 5, fig. 171.
Terebra multiplicata H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 101, pl. 1, fig. 19.
Mitra elegans H. C. Lea, *ibid.*, p. 102, pl. 1, fig. 22 is close to this species though it is more finely striated.
Terebrifusus amœnus Con., Amer. Jr. Conch., vol. 1, 1865, p. 28.
Buccimitra amœna Con.

amœnum Con.

Solarium amœnum Con., Foss. Sh. Tert. Form., Nov., 1833, p. 44; pl. 17, fig. 8 of 2d edition.

anatina Lea.

Marginella anatina Lea, Cont. to Geol., Dec., 1833, p. 176, pl. 6, fig. 186.
Syn. of *M. crassilabra* Con., which see.

antiquus Con.

Chiton antiquus Con., Proc. Acad. Nat. Sci., vol. 7, 1855, p. 266. See also Amer. Jr. Conch., 1865, p. 212, pl. 20, fig. 7.

antiquata Con.

Littorina antiquata Con., Foss. Sh. Tert. Form., Sept., 1833, p. 35.
Tuba alternata Lea, Cont. to Geol., Dec., 1833, p. 128, pl. 4, fig. 118.
Tuba striata Lea, *idem.*, p. 128, pl. 4, fig. 117.
?*Tuba sulcata* Lea, *idem.*, p. 129, pl. 4, fig. 119.
Tuba antiquata Con.

antrosum Con.

Solarium antrosum Con., Foss. Sh. Tert. Form., Sept., 1833, p. 31.
Type lost.

arata Con.

Emarginula arata Con., Foss. Sh. Tert. Form., No. 4, Nov., 1833, p. 44.
E. arata Con., Foss. Sh. Tert. Form., 2d ed., 1833, p. 39, pl. 15, fig. 8.

arctatus Con.

Sigaretus arctatus Con., Foss. Sh. Tert. Form., No. 4, Nov., 1833, p. 45.
Catinus arctatus Con.

armigera Con.

Melongina? armigera Con., Foss. Sh. Tert. Form., No. 3, Sept., 1833, p. 30.
Monoceros armigera Con., " " Nov., 1853.
Fusus taitii Lea, Cont. to Geol., Dec., 1833, p. 152, pl. 5, f. 159.
Monoceros armigerus Con., Foss. Sh. Tert. Form., 2d ed., 1835, p. 37, pl. 15, fig. 1.
Cornulina armigera Con., Am. Jour. Conch., 1865.

astartiformis Con.

Diplodonta astartiformis Con., Jour. Ac. Nat. Sci., 1860, vol. 4, p. 296; Am. Jr. Conch., vol. 1, 1865, p. 147, pl. 11, fig. 15.
Type lost.

aviculoides Con.

Pectunculus aviculoides Con., Foss. Sh. Tert. Form., No. 4, Nov., 1833, p. 39.
P. obliqua Lea, Cont. to Geol., Dec., 1833, p. 78, pl. 3, fig. 57.
Limopsis aviculoides Con., Jr. Ac. Nat. Sci., vol. 4, 1860, p. 297.

axacuum Con.

See **exacuum.**

babylonica Lea.

Cancellaria babylonica Lea, Cont. to Geol., Dec., 1833, p. 138, pl. 5, fig. 134.
Probably, though not certainly a synonym of *C. gemmata* Con.

baumontii Lea.

Pleurotoma baumontii Lea, Cont. to Geol., 1833, p. 134, pl. 4, fig. 127; probably young of *P. lesueurii* Lea, which see.

bellus Con.

Fusus bellus Con., Foss. Sh. Tert. Form., Nov., 1833, p. 43.
F. crebrissimus Lea, Cont. to Geol., Dec., 1833, p. 147, pl. 5, fig. 149.
F. magnocostatus Lea, *idem*, fig. 150.
F. bellus Con., Foss. Sh. Tert. Form., 1835, p. 56, pl. 18, fig. 11.

bella Con.

Nucula bella Con., Amer. Jour. Sci., vol. 23, Jan., 1833, p. 343.
N. plicata Lea, Cont. to Geol., Dec., 1833, p. 85, pl. 3, fig.64.
Leda bella Con., Proc. Acad. Nat. Sci., 1854, p. 29.

bella Con.

Scalaria (*Cirsostrema*) *bella;* labelled specimen in the collection of the Academy.

bellum Con.

Solarium (*Solariorbis*) *bellum* Con.; labelled specimen.
Syn. of *S. granulatum* Lea, which see.

bicarinatus Lea

Fusus bicarinatus Lea, Cont. to Geol., Dec., 1833, p. 146, pl. 5, fig 147,
A synonym of *F. trabeatus* Con., which see.

bilineatum Lea

Solarium bilineatum Lea, Cont. to Geol., Dec. 1833, p. 119, pl. 4, fig. 106.
Synonym of *S. alveatum* Con., which see.

bilix Con.

Sigaretus bilix Con., Amer. Jr. Sci., vol. 23, 1833, Jan., p. 344.
Natica striata Lea, Cont. to Geol., Dec., 1833, Jan., p. 105,, pl. 4, fig. 88.
Stomatia bilix Con., Proc. Acad. Nat. Sci., 1854, p. 30.
Catinus bilix Con., Amer. Jour. Conch., vol. 1, 1865, p. 27.
" " collection of the Academy.

biplicata Lea

Marginella biplicata Lea, Cont. to Geol., Dec., 1833, p. 201, pl. 6, fig. 216.
Ringicula biplicata Con., Amer. Jr. Conch., 1865, p. 35.
Still labelled *Marginella* in the Lea collection.

biseriata Con.

Pleurotoma biseriata Con., Appendix to Morton's Synopsis of Organic Remains etc., 1834.
Surcula biseriata Con., Amer. Jr. Conch., 1865, p. 18.

This has evidently never been described; the type was not found in the Academy's collection.

blainvillii Lea

Solecurtus blainvilli Lea, Cont. to Geol., 1833, p. 39, pl. 1, fig. 7

Psammocola blainvillii Con., Am. Jr. Conch., 1865. p. 4.

bolaris Con.

Mitra bolaris Con., Foss. Sh. Tert. Form., No. 3, Sept., 1833, p. 34; pl. 16. fig. 11, 2nd ed.

Mitra flemingii Lea, Cont. to Geol., Dec., 1833, p. 170, pl. 6, fig. 177.

Mitra humboldtii Lea, Cont. to Geol., Dec., 1833, p. 170, pl. 6, fig. 177.

Mitra bolaris Con., Foss. Sh. &c. 2d ed., 1835, p. 43, pl. 16, f. 11.

bombylis Con.

Oliva bombylis Con., Foss. Sh. Tert. Form., Sept., 1833, p. 32.

Oliva constricta Lea, Cont. to Geol., Dec. 1833, p. 182, pl. 6, fig. 195.

Olivia bombylis Con., Foss. Sh. &c. 2d ed., 1835, p. 42, pl. 16, fig. 4.

brevicostatus Con.

Cassis brevicostatus Con., Jr. Ac. Nat Sci., vol. 7, 1834, p. 146.

Semicassis brevicostatus Con. Amer. Jr. Conch., vol. 1, 1865, p. 25.

Cassis (*Phalium*) *globosum* Dall, Tr. Wag. Free Inst. Sci. vol. 3, 1890, p. 161 & p. 262, pl. 20, figs. 6, 11.

broderipii Lea

Pectunculus broderipii Lea, Cont. to Geol., Dec., 1833, p. 76, pl. 3, fig. 53.

Synonym of *P. stamineus* Con., which see.

brogniarti Lea

Nucula brogniarti Lea, Cont. to Geol., Dec., 1833, p. 82, pl. 3, fig. 61.

Synonym of *N. cœlata* Con., which see.

bucklandii Lea

Egeria bucklandii Lea, Cont. to Geol., Dec., 1833, p. 52, pl 1, fig. 21

Synonym of *Donax limatula* Con., which see.

cælata Lea

Pleurotoma cælata Lea, Cont. to Geol., Dec., 1833, p. 132, pl. 4, fig 123.

Syn. of *P. tabulata*, which see.

cælata Con.

Nucula cælata Con., see *N. cœlata* Con.

cælatura Con.

Architectonia cælatura Con., Amer. Jr. Conch., vol., 1, 1865, p. 144, pl. 11, fig. 13.

callifera Con.

Pleurotoma callifera Con., Foss. Sh. Tert. Form., 2d ed., 1835, p. 52.

Not seen in the Academy's collection nor given by Conrad in Am. Jr. Conch. vol. 1, 1865, p. 18 or 19.

callosa Con.

Astarte collosa Con., Foss. Sh. Tert. Form., Sept., 1833, p. 38.

Type lost.

cancellata Lea

Nassa cancellata Lea, Cont. to Geol., Dec., 1833, p. 165, pl., 5, fig. 170.

Syn. of *Buccinum sagenum* Con., which see.

cancellata H. C. Lea

Pasithea cancellata H. C. Lea, Am. Jr. Sci. vol. 40, 1840, p. 93, pl. 1, fig. 2.

cancellata H. C. Lea

Pleurotoma cancellata H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 98, pl. 1, fig. 13.

cancellata Lea

Pyrula cancellata Lea, Cont. to Geol., Dec., 1833, p. 154, pl. 5, fig. 160.

Syn. of *P. penita* Con., which see.

cancellatum Con.

Solarium cancellatum Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 344.

This has a strongly cancellated base. For figure see Foss. Sh. Tert. Form., 2d ed., 1835, p. 49, pl. 17, fig. 11.

Architectonica cancellata Con., Am. Jr. Conch., vol. 1, 1865, p. 29.

cancellatum Lea

Solarium cancellatum Lea, Cont. to Geol., Dec., 1833, p. 121, pl. 4 fig. 110.

Probably equivalent to *S. cancellatum* Con., which see.

carinata Lea

Scalaria carinata Lea, Cont. to Geol., Dec., 1833, p. 116, pl. 4, fig. 103.

Most probably identical with *S. nassula* Con., which see.

carinata Lea.

Turritella carinata Lea., Cont. to Geol., 1833, p. 129, pl. 4. fig. 120.

carinata H. C. Lea

Turritella carinata H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 96, pl. 1, fig. 10.

T. apita Greg., Mon. Faun. Éoc. de l'Ala., 1890.

H. C. Lea evidently shared the opinion of Conrad, viz., that *T. carinata* Lea was the equivalent of *T. mortoni* Con., otherwise he would scarcely have re-proposed this name.

carinifera Con.

Lucina carinifera Con., Foss. Sh. Tert. Form., Nov., 1833, p. 40.

L. cornuta Lea, Cont. to Geol., Dec., 1833, p. 56, pl. 1, f. 29.

L. carinifera Con., Amer. Jr. Sci., vol. 1, 1846, p. 402, pl. 4, fig. 15.

carinifera Lea

Nucula carinifera Lea, Cont. to Geol., Dec., 1833, p. 198, pl. 6, fig. 212.

Syn. of *Pectunculus cuneus* Con., which see.

childreni Lea

Pleurotoma childreni Lea Cont. to Geol., 1833, p. 137, pl. 4, fig. 132.

P. acutirosta Con., Foss. Sh. Tert. Form., 2d ed., 1835, p. 52, pl. 17, fig. 21.

Acutirostra seems to be a variety of *childreni*, but the type of the latter is missing.

claibornensis Lea

Anatina claibornensis Lea, Cont. to Geol., 1833, p. 40, pl. 1, f. 8.

claibornensis Lea.

Avicula claibornensis Lea, Cont. to Geol., Dec., 1833, p. 86, pl. 3.

Syn. of *A. limula* Con., which see.

claibornensis Con.

Cerithium claibornensis Con., Jr. Ac. Nat. Sci., vol. 1, 1848, p. 132, pl. 14, fig. 32.
Cerithiopsis claibornenses Con., Am. Jr. Conch., 1865, p. 29.

claibornensis Con.

Cirsostrema claibornensis Con., Amer. Jr. Conch., vol. 1, 1865, p. 211, pl. 20, fig. 12.
Probably belongs to *Scala nassula*, which see.

claibornensis Lea

Conus claibornensis Lea, Cont. to Geol., Dec., 1833, p. 186.
Evidently the young of *C. sauridens*. Type lost.

claibornensis Lea

Fissurella claibornensis Lea, Cont to Geol., Dec., 1833, p. 94, pl. 3, fig. 74.
Synonym of *F. tenebrosa* Con., which see.

claibornensis Con.

Lithodomus claibornensis Con., Jr. Acad. Nat. Sci., vol. 1, 2d ser. p. 132, pl. 14, fig. 27.
Lithophaga claibornensis Con., Amer. Jr. Conch., 1865, p. 11.

claibornensis Con.

Nucula claibornensis Con., Jr. Ac. Nat. Sci., 2d ser., vol. 1, p. 131, pl. 14, fig. 22.
Nuculana claibornensis Con., Amer. Jr. Conch., 1865, p. 13.
Type lost.

claibornensis Con.

Ostrea claibornensis Con., MS. Museum specimen.
The adult form of *O. alabamensis* Lea, which see.

claibornensis Lea

Pasithea claibornensis Lea, Cont. to Geol., 1833, p. 104, pl. 4, f. 87.

claibornensis Con.

Pecten claibornensis Con. MS.; labelled specimen.

claibornensis Lea.

Siliquaria claibornensis Lea, Cont. to Geol., Dec., 1833, p. 33, pl. 1. fig. 1.
Syn. of *S. vitis* Con.

cœlata Con.

Nucula cœlata Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 343.
N. brogniartii Lea, Cont. to Geol., Dec., 1833, p. 82, pl. 3, f. 67.
Leda cœlata Con., Proc. Ac. Nat. Sci., 1854, p. 29.

cœlata Lea

Pleurotoma cœlata Lea, Cont. to Geol., 1833, p. 132, pl. 4, fig. 123.
Syn. of *P. tabulata* Con.

columba Lea

Marginella columba Lea, Cont. to Geol., Dec., 1833, p. 177, pl. 6, fig. 187.

M. columba Con., Foss. Sh. Tert. Form., 2d ed., 1835, p. 45, pl. 16, fig. 16.

comis Lea

Cytherea comis Lea, Cont. to Geol., 1833, p. 66, pl. 2, fig. 41.
Syn. of *C. perovata* Con., which see.

compressa Lea

Corbula compressa Lea, Cont. to Geol., 1833, p. 47, pl. 1, fig. 15.

compressa Lea

Lucina compressa Lea, Cont. to Geol., Dec., 1833, p. 55, pl. 1, fig. 27.

Syn. of *L. pandata*, Con., which see

conoides Con.

Pleurotoma conoides Con., Foss. Sh. Tert. Form., 1835, p. 51, pl. 17, fig. 17.

Conorbis conoides Con., Am. Jr. Conch., 1865, p. 20.

constricta Con.

Marginella constricta Con., Foss. Sh. Tert. Form., 2d. ed., 1835, p. 46, pl. 16, fig. 15. It is doubtful whether the specimen so labelled is the type, or even this species.

constricta Lea

Oliva constricta Lea, Cont. to Geol., Dec., 1833, p. 182, pl. 6, fig. 195.

Synonym of *O. bombylis* Con., which see.

constricta H. C. Lea

Terebra constricta H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 100, pl. 1, fig. 18.

conybearii Lea

Fusus conybearii Lea, Cont. to Geol., Dec., 1833, p. 149, pl. 5.
This may prove to be a variety of *F. limulus* Con.

cooperi Con.

Fusus cooperi Con., Jr. Acad. Nat. Sci., vol. 7, 1834, p. 148.

F. cooperi Con., Foss. Sh. Tert. Form., 2d. ed., pl. 18, fig. 15.
Clavifusus cooperii Con. Museum coll.

cooperii Lea

Voluta cooperii Lea, Cont. to Geol., Dec., 1833, p. 175, pl. 6, fig. 185. Synonym of *Mitra doliata* Con., which see.

corbuloides Con.

Pectunculus corbuloides Con., Foss. Sh. Tert. Form., No. 4, Nov., 1833. p. 40.
Limopsis corbuloides Con., Jour. Acad. Nat. Sci., vol. 4, 1860, p. 297.

This is probably from the Lower Claiborne at the base of Claiborne Bluff.

cornu-arietes Lea

Crepidula cornu-arietes Lea, Cont. to Geol., Dec., 1833, p. 97, pl. 3, fig. 77.
Synonym of *Crepidula lirata* Con., which see.

cornuta Lea

Lucina cornuta Lea, Cont. to Geol., Dec., 1833, p. 56, pl. 1, fig. 29.

Synonym of *L. carinifera* Con., which see.

costata Lea

Cancellaria costata Lea, Cont. to Geol., 1833, p. 141, pl. 5, f. 140.

costatus Lea

Myoparo costatus Lea, Cont. to Geol., Dec., 1833, p. 74, pl. 2, fig. 51.

Synonym of *Stalagmium margaritaceum* Con., which see.

costata Lea

Terebra costata Lea, Cont. to Geol., 1833, p. 166, pl. 5, fig. 172.

A specimen of this species in the Conradian collection is labelled *Lirofusus gracilis*.

costellatus Con.

Acteon costellatus Con., Foss. Sh. Tert. Form., 1833, p. 45.
Actæon (*Nucleopsis*) *costellatus* Con., Amer. Jr. Conch., 1865, p. 34. Type lost.

crassilabra Con.

Marginella crassilabra Con., Foss. Sh. Tert. Form., Sept., 1833 p. 33; 2d ed., 1835, p. 45, pl. 13, fig. 13.
Marginella anatina Lea, Cont. to Geol., Dec., 1833, p. 176, pl. 6, fig. 186.

crassilabra Lea

Marginella crassilabra Lea, Cont. to Geol., Dec., 1833, p. 177, pl. 6, fig. 188.

Synonym of *M. humerosa* Con., which see.

crebrissimus Lea

Fusus crebrissimus Lea, Cont. to Geol., 1833, p. 147, pl. 5, f. 149.

A variety of *F. bellus* Con., which see.

cuculloides Con.

Arca cuculloides Con., Foss. Sh. Tert. Form., No. 3, 1833, p. 37.
Navicula cuculloides Con., Proc. Ac. Nat. Sci., 1854, p. 29.
Cucullæarca cuculloides Con., Amer. Jr. Conch., vol. 1, 1865, p. 11.

cuneus Con.

Pectunculus cuneus Con., Amer. Jr. Sci., vol. 23, 1833, (Jan.), 342.
Nucula carinifera Lea, Cont. to Geol., Dec., 1833, p. 198, pl. 6, fig. 212.
Trigonocœlia cuneus Con., Amer. Jr. Conch., vol. 1, 1865, p. 12.
Limopsis cuneus, Con., Jour. Ac. Nat. Sci., vol. 4, 1860, p. 297, pl. 46, fig. 17.

curta Con

Monoptygma curta Con., Amer. Jr. Conch., vol. 1, p. 143, pl. 11. fig. 8.

cuvieri Lea

Rostellaria cuvieri Lea, Cont. to Geol., Dec., 1833, p. 160, pl. 5, fig. 165.

Synonym of *R. laqueata* Con. which see.

decisus Con.

Fusus decisus Con., Foss. Sh. Tert. Form., Nov., 1833, p. 43.
Type lost.

decisa Con.

Mactra decisa Con., Foss. Sh. Tert. Form., Nov., 1833, p. 42.
M. decisa Con. Am. Jr. Sci.,. 2d ser., vol. 1, p. 216, pl. 2, fig. 3.

decisus Con.

Pectunculus decisus Con., Foss. Sh. Tert. Form., No. 4, Nov., 1833, p. 39.
? *Nucula pectuncularis* Lea, Cont. to Geol., Dec., 1833, p. 81, pl. 3, fig. 60.
Limopsis *decisus* Con., Jr. Ac. Nat. Sci., vol. 4, 1860, p. 297.

declivis Con.

Pectunculus declivis Con., Foss. Sh. Tert. Form., No. 4, 1833, p. 39.
Pectunculus minor Lea, Cont. to Geol., Dec., 1833, p. 77, pl. 3, fig. 54.
Limopsis declivis Con., Jr. Ac. Nat. Sci., vol. 4, 1860, p. 297.

declivus Con.

Sigaretus declivus Con., Foss. Sh. Tert. Form., No. 4, Nov. 1833, p. 45.
Stomatia declivus Con., Pr. Ac. Nat. Sci., 1854, p. 30.

The same as some forms of *Natica striata* Lea.

decussatus Lea

Fusus decussatus Lea, Cont. to Geol., 1833, p. 145, pl. 5, fig. 146.

Syn. of *Fusus thoracicus* Con., which see.

defrancii Lea

Voluta defrancii Lea, Cont. to Geol., 1833, p. 171, pl. 6, f. 179.
A form of *V. sayana* Con., which see.

dekayi Lea.

Bulla dekayi Lea, Cont. to Geol., Dec., 1833, p. 200, pl. 6, f. 215.

delabechii Lea.

Fusus delabechii Lea, Cont. to Geol., 1833, p. 148, pl. 5, f. 151.
Called *Strepsidura lirata* in the Conradian collection.

deltoidea Con.

Diplodonta deltoidea Con., Jr. Acad. Nat. Sci., vol. 4, 1860, p. 296.
Mysia deltoidea Con., Am. Jr. Conch., 1865, p. 147, pl. 11, f. 10.
Not seen in the collection.

deltoideus Lea

Pectunculus deltoideus Lea, Cont. to Geol., Dec., 1833, p. 77, pl. 3, fig. 55.
Syn. of *P. trigonellus* Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 342.

dentata Lea

Mactra dentata Lea, Cont. to Geol., Dec., 1833, p. 41, pl. 1, f. 9.
Syn. of *Lutraria papyrea* Con., which see.

depressa Lea

Delphinula depressa Lea, Cont. to Geol., Dec., 1833, p. 118, pl. 4, fig. 105.
Solariorbis depressa Con., Amer. Jr. Conch., vol., 1, 1865, p. 30.

depygis Con.

Pleurotoma depygis Con., Foss. Sh. Tert. Form., Nov., 1833, p. 46.

P. depygis Con., Foss. Sh. Tert. Form., 2d. ed., p. 52, pl. 17, fig. 20.

Lea's *P. monilifera* is evidently the young of *depygis*.

Some of the so-called types of *depygis* are *P. sayi* Lea, others are *P. desnoyersii* Lea.

deshaysii Lea

Pecten deshaysii Lea ,Cont. to Geol., 1833, p. 87, pl. 3, fig. 66.

desnoyersii Lea

Pleurotoma desnoyersii Lea, Cont. to Geol., Dec., 1833, p. 135, pl. 4, fig. 128.

discoidalis Con.

Cytherea discoidalis Con., Foss. Sh. Tert. Form., Sept., 1833, p. 37; pl 20, fig. 2 of Harris's reprint.

C. trigoniata Lea, Cont. to Geol., Dec., 1833, p. 67, pl. 2, f. 44.

distans Con.

Corbis distans Con., Foss. Sh. Tert. Form., Nov., 1833, p. 41.

Syn. of *C. undata* Con.

divaricata Lea

Ostrea divaricata Lea, Cont. to Geol., 1833, p. 91, pl. 3, f. 70.

Although evidently related to *O. sellæformis* Con., these two two may perhaps be regarded as specifically distinct.

dolabra Con.

Lucina dolabra Con., Am. Jr. Sci. , vol. 23, Jan., 1833, p. 343.

Lucina dolabra Con., Foss. Sh. Tert. Form., 1833, p. 40.

Astarte recurva Lea, Cont. to Geol., Dec. 1833, p. 61, pl. 2, f. 34.

doliata Con.

Mitra doliata Con., Foss. Sh. Tert. Form., Sept., 1833, p. 34.

Voluta cooperii Lea, Cont. to Geol., Dec., 1833, p. 175, pl. 6, fig. 185.

Caricella doliata Con., Am. Jr. Conch., vol. 1, 1865, p. 24.

According to Conrad his *Turbinella prisca*, Foss. Sh. &c., No. 4, p. 45 and 2d ed. p. 43, pl. 16, fig 9, (as *Voluta*) is the same as his *doliata*. *T. prisca* was not observed in the Academy's collection.

donacea Con.

Egeria donacea Con., Am. Jr. Conch. vol. 1, 1865, p. 146, pl. 11, fig. 12.

dubia Lea

Oliva dubia Lea. Cont. to Geol., Dec., 1833, p. 183, pl. 6, fig. 198.

Syn. of *O. alabamensis* Con., which see.

dubia H. C. Lea

Voluta dubia H. C. Lea, Am. Jr. Sci., vol. 40, 1841, p. 103, pl. 1, fig 23.

Syn. of *Mitra pactilis* which see.

dumosa Con.

Crepidula dumosa Con., Jr. Ac. Nat. Sci., vol. 7, 1834, p. 148.

C. dumosa Con., Foss. Sh. Tert. Form., 2d ed., 1835, p. 46, pl. 16, f. 20.

Most probably an abnormal form of *C. lirata* Con.

eborea Con.

Natica eborea Con., Foss. Sh. Tert. Form., No. 4, Nov., 1833, p. 46.

Type lost. Equivalent to *Dillwynella naticoides* Lea.—Dall.

eborea Con.

Psammobia eborea Con., Foss. Tert. Form., No. 4, 1833, p. 42.

Psammocola eborea Con., Am. Jr. Conch., 1865, p. 4.

eburnea H. C. Lea

Mitra eburnea H. C. Lea, Am. Jr. Sci., 1841, vol. 40, p. 102, pl. 1, fig, 21.

M. minima is perhaps the young of this.

elaborata Con.

Pleurotoma elaborata Con., Foss. Sh. Tert. Form., No. 4, Nov. 1833, p. 46.

Pl. elaborata Con., Foss. Sh. &c., 1835, p. 52, pl. 17, fig. 19.

Moniliopsis elaborata Con., Amer. Jr. Conch., 1865, p. 143.

elaboratum Lea

Solarium elaboratum Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 344.

S. elaboratum Con., Foss. Sh. Tert. Form., 1835, p. 47, pl. 17, fig. 4.

Architectonica elaborata Con., Amer. Jr. Conch., vol. 1, p. 29.

elegans H. C. Lea

Mitra elegans H. C. Lea, Amer, Jr. Sci., vol. 40, 1840, p. 102, pl. 1, fig. 22.

See *Buccinum amœnum* Con.

elegans Lea

Monoptygma elegans Lea, Cont. to Geol., Dec., 1833, p. 203, pl. 6, fig. 217.

This is perhaps the young of *Actæon pomilius* Con.

elegans H. C. Lea

Pasithea elegans H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 93, pl. 1, fig. 3.

elegans H. C. Lea

Scalaria elegans H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 95, pl. 1, fig. 6. A small *Turbonilla.*

elegans Lea

Solarium elegans Lea., Cont. to Geol., 1833, p. 121, pl. 4, f. 109. Syn. of *S. stalagmium* Con., which see.

elegantissima Lea

Pyrula elegantissima Lea, Cont. to Geol., Dec., 1833, p. 155, pl. 5, fig. 161.

Syn. of *P. penita* Con., which see.

elevatus Lea

Actæon elevatus Lea, Cont. to Geol., Dec., 1833, p. 113, pl. 4, fig. 98.

Syn. of *Pyramidella larvata* Con., which see.

elevata Lea

Cancellaria elevata Lea, Cont. to Geol., Dec., 1833, p. 141, pl. 5, fig. 139.

A high var. of *sculpturata* Lea, *alveata* Con., which see.

elevata Lea

Fasciolaria elevata Lea, Cont. to Geol., 1833, p. 143, pl. 5, fig. 143.

This is close to *Neptunea parbrazana* Har.; it is slightly striated on the columella below, and is more slender than the Texan form.

ellipsis Lea

Pectunculus ellipsis Lea, Cont. to Geol., Dec., 1833, p. 78, pl. 3, fig. 56.

A small *P. perplanus* Con., which see.

eminula Con.

Natica eminula Con., Foss. Sh. Tert. Form., Nov., 1835, p. 46.
N. parva Lea, Cont. to Geol., Dec., 1833, p. 106, pl. 4, fig. 89.
N. minor Lea, Cont. to Geol., Dec., 1833, p. 107, pl. 4, fig. 90.

engonatus Con.

Murex engonatus Con., Foss. Sh. Tert. Form., Sept., 1833, p. 30; Amer. Jour. Conch., vol. 1, 1865, p. 219, pl. 20, fig. 10.

Fusus sexangulus Con., Jr. Ac Nat. Sci., vol. 7, 1834, p. 144.

eocensis Con.

Chiton eocensis Con., Proc. Ac. Nat. Sci., vol. 7, p. 263.

C. eocensis Con., Amer. Jr. Conch., 1865, p. 212, pl. 20, fig. 6.

equalis Con.

Nucula equalis Con., Foss. Sh. Tert. Form., Nov., 1833, p. 46.

N. media Lea, Cont. to Geol., Dec., 1833, p. 83, pl. 3, fig. 62.

Leda æqualis Con., Proc. Ac. Nat. Sci., 1854, p. 29.

Nuculana æqualis Con., Amer. Jr. Conch., 1865, p. 13 and in the collection of the Academy.

exacuum Con.

Solarium axacuum Con., Foss. Sh. Tert. Form., Nov., 1833, p. 44.

Delphinula plana Lea, Cont. to Geol., Dec., 1833, p. 117, pl. 4, fig. 104.

Solarium exacuum Con., Foss. Sh. Tert. Form., 2d ed., 1835, p. 48, pl. 17, fig. 5.

Architectonica exacua Con., Amer. Jr. Conch., vol. 1, p. 29.

explicatus Con.

Fusus explicatus Con., Foss. Sh. Tert. Form., Nov., 1833, p. 43. Type lost.

filamentosa Con.

Plicatula filamentosa Con., Foss. Sh. Tert. Form., Sept., 1833, p. 38.

P. mantilli Lea, Cont. to Geol., Dec., 1833, p. 89, pl. 3, fig. 68.

filosa Con.

Psammobia filosa Con., Foss. Sh. Tert. Form., Nov., 1833, p. 42.

Gari filsoa Con., Am. Jr. Conch., vol. 1, 1865, p. 4,

fittonii Lea

Fusus fittonii Lea, Cont. to Geol., Dec., 1833, p. 150, pl. 5, fig. 136.

Syn. of *F. inauratus* Con., which see.

Glued on the card with *F. fittonii* is an apex of *Pseudoliva vetusta* Con.

flemingii Lea

Mitra flemingii Lea, Cont. to Geol., Dec., 1833, p. 170, pl. 6, fig. 177.

Syn. of *Mitra bolaris* Con., which see.

funginum Con.

Solarium funginum Con., Foss. Sh. Tert. Form., 1833, p. 44.
S. henrici Lea, Cont. to Geol., Dec., 1833, p. 119, pl. 4, f. 107.
S. funginum Con., Foss. Sh. &c. 2d ed., 1835, p. 48, pl. 17, f. 7.
Architectonica fungina Con., Am. Jr. Conch., vol. 1, p. 29.

fusiformis Lea

Monoceros fusiformis Lea, Cont. to Geol., Dec., 1833, p. 162, pl. 5, fig. 167.
Syn. of *M. vetusta* Con.

fusoides Lea

Mitra fusoides Lea, Cont. to Geol., Dec., 1833, p. 169, pl. 6, fig. 176.
Conomitra fusoides (Lea) Con., Am. Jr. Conch., 1865. p. 25.

fusoides H. C. Lea

Turbinella fusoides H. C. Lea, Am. Jr. Sci., vol. 40, p. 98, pl. 1, fig. 14.
Synonym of *Fasciolaria plicata* Lea, which see.

galba Con.

Volvaria galba Con., Foss. Sh. Tert. Form., Sept., 1833, p. 34.
Bulla galba Con., ibid., 1835, p. 40, pl. 15, f. 14.
Bulla st. hillairii Lea, Cont. to Geol., Dec. 1833, p. 98, pl. 4, f. 78.
Cylichna galba Con., Amer. Jr. Conch., 1865, p. 35.

gemmata Con.

Cancellaria gemmata Con., Foss. Sh. Tert. Form., 1833, p. 35.
C. gemmata, *idem*, 1835, p. 44. pl. 16, fig. 10.
See *C. babylonica* Lea.

gemmata Con.

Pleurotoma gemmata Con., Foss. Sh. Tert. Form., 2d ed, 1835, p. 52, pl. 17, fig. 22.
Referred to *Surcula*, Amer. Jr. Conch., vol. 1, 1865, p. 18.

gibbosa Lea

Corbula gibbosa Lea, Cont. to Geol., 1833, p. 46, pl. 1, fig. 14.
Mistaken by Conrad for a variety of his *oniscus*.

gibbosa Lea

Natica gibbosa Lea, Cont. to Geol., 1833, p. 108, pl. 4, fig. 92.
An unusually high variety of *N. limula* Con. which see.

gigantea Lea

Anolax gigantea Lea, Cont. to Geol., Dec., 1833, p. 180, pl. 6. fig. 193.
Syn. of *Ancillaria altile* Con., which see.

globosa Lea

Cytherea globosa Lea, Cont. to Geol., Dec., 1833, p. 65, pl. 2, fig. 40.

Synonym of *C. poulsoni* Con., which see.

gracilis Con.

Lirofusus gracilis; Conrad's MS. name for *Terebra costata* Lea.

gracilis H. C. Lea

Mitra gracilis H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 101, pl. 1, fig. 20.

gracilis Lea.

Oliva gracilis Lea, Cont. to Geol., Dec., 1833, p. 182, pl. 6, fig. 196.

A very small and slender variety of *O. alabamensis* Con.

gracilis Con.

Terebra gracilis Lea, Cont. to Geol., 1833, p. 166, pl. 5, fig. 171. See *Buccinum amœnum*.

gracilis H. C. Lea

Turritella gracilis H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 97, pl. 1, fig. 12.

gracilis Con.

Typhis gracilis Con., Amer. Jr. Sci., Jan., 1833, p. 344.

Murex alternata Lea, Cont. to Geol., 1833, p. 157, pl. 5, f. 163,

gracilis Lea

Voluta gracilis Lea, Cont. to Geol., Dec. 1833, p. 172, pl. 6, fig. 180.

Young of *V. sayana* Con.

granulatum Lea

Solarium granulatum Lea, Cont. to Geol., Dec., 1833, p. 122, pl. 4. fig. 111.

grayi Lea

Mactra grayi Lea, Cont. to Geol., Dec., 1833, p. 42, pl. 1, fig. 10. Synonym of *Erycina æquorea* Con., which see.

greenoughi Lea

Oliva greenoughi Lea, Cont. to Geol., 1833, p. 183, pl. 6, f. 197. Syn. of *O. alabamensis* Con., which see.

guttula Lea

Pasithea guttula Lea, Cont. to Geol., Dec., 1833, p. 104, pl. 4, fig. 86.

henrici Lea

Solarium henrici Lea, Cont. to Geol., 1833, p. 119, pl. 4, f. 107.
Syn. of *Solarium funginum* Con., which see.

hæninghausii Lea

Pleurotoma hæninghausii Lea, Cont. to Geol., 1833, p. 135, pl. 4, fig. 129.

This somewhat resembles *P. rugosa* Lea.

On the card marked *P. hæninghausii* there is one good specimen of *rugosa* and one very small specimen of *hæninghausii*. The type specimen is lost or is in the tray marked "*P. hæninghausii* Lea, T. A. Conrad, Claiborne, Ala."

humboldtii Lea.

Mitra humboldtii Lea, Cont. to Geol., Dec., 1833, p. 170, pl. 6, fig. 178.
Syn. of *Mitra bolaris* Con., which see.

humerosa Con.

Marginella humerosa Con., Foss. Sh. &c., 1835, p. 45, pl. 16, fig. 14.

M. crassilabra Lea, Cont. to Geol., Dec., 1833, p. 177, pl. 6, fig. 188.

hydana Con.

Cytherea hydana Con., Foss. Sh. Tert. Form., Sept., 1833, p. 36; pl. 20, fig. 3 of Harris's republication.

Gratelupia moulinsii Lea, Cont. to Geol., Dec., 1833, p. 59, pl. 2, fig. 33.

Cytheriopsis hydana Con., Amer. Jr. Conch., 1865, p. 7 and 146.

hydii Lea.

Cytherea hydii Lea, Cont. to Geol. Dec. 1833, p. 66, pl. 2, f. 42.
Syn. of *C. æquorea* Con., which see.

idoneus Con.

Acteon idoneus Con., Foss. Sh. Tert. Form., Nov., 1833, p. 45.

A. lineatus Lea, Cont. to Geol., Dec., 1833, p. 112, pl. 4, fig. 97.

idoneus Con.

Pectunculus idoneus Con., Foss. Sh. Tert. Form., Nov., 1833, p. 39.

impressa Con.

Cancellaria impressa Con., Amer. Jr. Conch., 1865, p. 145, pl. 11, fig. 16.

impressa Lea.

Lucina impressa Lea, Cont. to Geol., Dec., 1833, p. 57, pl. 1, fig. 30.

Syn. of *L. pomilia* Con., which see.

inauratus Con.

Fusus inauratus Con., Foss. Sh. Tert. Form., Sept., 1833, p. 29; 2d. ed., 1835, p. 53, pl. 18, fig. 2.
F. fittonii Lea, Cont. to Geol. Dec., 1833, p. 150, pl. 5, fig. 156.
Bulbifusus inauratus Con., Am. Jr. Conch., vol. 1, 1865, p. 17.

incurva Lea

Marginella incurva Lea, Cont. to Geol., Dec., 1833, p. 179, pl. 6, fig. 192.

Probably the young of *M. columba* Lea.

inflata Lea

Egeria inflata Lea, Cont. to Geol., Dec., 1833, p. 50, pl. 1, f. 18.
Mysia (Sphærella) lævis Con., Am. Jr. Conch., vol. 1, p. 147.

irrasus Con.

Fusus irrasus Con., Jour. Ac. Nat. Sci., Phila., 1834, vol. 7, p. 145.

Also Foss. Sh. Tert. Form., 1835, p. 54, pl. 18, fig. 10.

isocardioides Lea

Hippagus isocardioides Lea, Cont. to Geol., Dec., 1833, p. 72, pl. 2, fig. 50.

lævis Con.

Drillia lævis Con., Amer. Jr. Conch., vol. 1, p. 19.

Syn. of *Pl. lonsdalii* Lea, which see.

lamarckii Lea

Rostellaria lamarckii Lea, Cont. to Geol., Dec. 1833, p. 158, pl. 5, fig. 164.

Syn. of *R. velata* Con., which see.

laqueata Con.

Rostellaria laqueata Con., Foss. Sh. Tert. Form., Nov., 1833, p. 41; pl. 15, fig. 4, of 2d. ed., 1835.
R. cuvieri Lea, Cont. to Geol., Dec., 1833, p. 160, pl. 5, f. 165.
Rimella laqueata Con., Proc. Ac. Nat, Sci., 1857, p. 166.

laqueata Con,

Strepsidura laqueata Con., Am. Jr. Conch., 1865, p. 210, pl. 21, fig. 1.

larva Con.

Fistulana larva Con. Amer. Jr. Sci.,. vol. 1, 1846, p. 212, pl. 2, fig. 5,
Gastrochæna larva Con., Amer. Jr. Conch., 1865, p. 2.

larvata Con.

Marginella larvata Con., Foss. Sh. Tert. Form., Sept., 1833, p. 33; 2d ed., p. 45, pl. 16, fig. 12.
M. ovata Lea, Cont. to Geol., 1833, p. 179, pl. 6, fig. 191.
Porcellana larvata Con., Proc. Ac. Nat. Sci., 1854, p. 31.
Volutella larvata Con., Am. Jr. Conch., 1865, p. 25.

larvata Con.

Pyramidella larvata Con., Foss. Tert. Form., Nov., 1833, p. 46.
Acteon elevatus Lea, Cont. to Geol., Dec., 1833, p. 113, pl. 4, fig. 98.
Obeliscus larvatus Con., Amer. Jr. Conch., 1865, p. 28.

latifrons Con.

Crenella latifrons Con., Jr. Ac. Nat. Sci., vol. 4, 1860, p. 296.

lesueurii Lea

Pleurotoma lesueurii Lea, Cont. to Geol., Dec. 1833, p. 137, pl. 4, fig. 133.

This differs from *P. alternata* in having a more prominent subsutural ridge and in having the sinus in a channel between this ridge and the carina. *Alternata* has less prominent revolving lines and the retral sinus is on the carina.

limatula Con.

Donax limatula Con., Foss. Sh. Tert. Form., Nov., 1833, p. 42.
Egeria triangulata Lea, Cont. to Geol., Dec., 1833, p. 51, pl. 1, fig. 20.
Egeria bucklandii Lea, *idem*, p. 52, pl. 1, fig. 21.
Egeria limatula Con.

limula Con.

Avicula limula Con., Foss. Sh. Tert. Form., Nov., 1833, p. 39.
Avicula claibornensis Lea, Cont. to Geol., Dec., 1833 p. 86, pl. 3, fig. 65.

limulus Con.

Fusus limulus Con., Foss. Sh. Tert. Form., Nov., 1833, p. 43; 2d ed. 1835, p. 53, pl. 18, fig. 4.
Fusus acutus Lea, Cont. to Geol., Dec., 1833, p. 149, pl. 5, f. 153.
Strepsidura limula Con.

limula Con.

Natica limula Con., Foss. Sh. Tert. Form., Nov., 1833, p. 46.
N. gibbosa Lea; an elevated variety of this species.
N. ætites Con., (*N. mamma* Lea,) is most probably a low or deform of this species.

lineatus Lea

Acteon lineatus Lea, Cont. to Geol., Dec., 1833, p. 112, pl. 4, fig. 97.
Syn. of *A. idoneus* Con., which see.

lineata Lea

Mitra lineata Lea, Cont. to Geol., Dec., 1833, p. 168, pl. 5. fig. 174.
Fusimitra? lineata (Lea) Con., Am. Jr. Conch., vol. 1, p. 25.

lineata Lea

Turbo lineata Lea, Cont. to Geol., 1833, p. 126, pl. 4, fig. 116.
Solarium lineatum Con., Foss. Sh. Tert. Form., 2d ed. 1835, p 50, pl. 17, fig. 12.
Solariorbis lineatus Con., Am. Jr. Conch. vol. 1, 1865, p. 30.

lineata Lea

Turritella lineata Lea, Cont. to Geol., Dec. 1833, p. 130, pl. 4, fig. 121.
Syn. of *T. obruta* Con., which see.

lingula canis Lea

Ostrea lingula canis Lea, Cont. to Geol., 1833, p. 92, pl. 3, f. 72.
Syn. of *O. alabamiensis* Lea., which see.

linosa Con.

Amphidesma linosa Con., Foss. Sh. Tert. Form., 1833, p. 42; Harris's republication, pl. 19, fig. 13. See also Am. Jr. Sci., vol. 1, 1846, p. 397, pl. 4, fig. 2.
Semele linosa Con., Amer.. Jr. Conch., 1865, p. 5.

lirata Con.

Crepidula lirata Con., Am. Jr. Sci., vol. 23, Jan., 1833, p. 344.
C. lirata Con. ,Foss. Sh. Tert. Form., 1835, p. 46, pl, 16, fig. 17.
C. cornu arietes Lea, Cont. to Geol., 1833, p. 97, pl. 3, fig. 77.
C. dumosa Con., is most probably an abnormal form of this species.

liratum Con.

Gafrarium liratum Con., Am. Jr. Conch., p. 9. This species was at first referred by Conrad to *Corbis lamellosa* Lam., (Am. Jr. Sci., 2d. ser., 1846, p. 401, pl. 4, fig. 16.) A figure is given of the species on pl. 19 of Harris's republication of Foss. Sh. Tert. Form.

lirata Con.

Pleurotoma lirata Con., Proc. Ac. Nat. Sci., 1865. Con. labelled specimen in Acad. coll.

lintea Con.

Strepsidura lintea Con. Amer. Jr. Conch., vol. 1, 1865, p. 142 and 210, pl. 20, fig, 1.

lirata Con.

Strepsidura lirata Con.
Fusus delabechii Lea.

lonsdalii Lea

Pleurotoma lonsdalii Lea, Cont. to Geol., Dec. 1833, p. 132, pl. 4, fig. 124.
Drillia lævis Con., Amer. Jr. Conch., 1865, p. 19.

On the card marked *P. lonsdalii* Lea there are three specomens of which the largest is *P. cælata* Lea, another is an unknown form and a third is *P. lonsdalii.*

Of *D. lævis* there are about a dozen specimens so named; others are in a tube.unnamed.

lugubris Lea

Pasithea lugubris Lea, Cont. to Geol., 1833, p. 101, pl. 4, f. 81.

lunata Lea

Lucina lunata Lea, Cont. to Geol., Dec., 1833, p. 58, pl. 1, f. 32.
Syn. of *L. alveata* Con.

lyelli Lea

Pecten lyelli Lea, Cont. to Geol., 1833, p. 88, pl. 3 fig. 67.

lymneoides Con.

Ancillaria lymneoides Con., Foss. Sh. Tert. Form., 1833, p. 44; pl. 16, fig. 6 of 2d ed.
Monoptygma alabamiensis Lea, Cont. to Geol., Dec., 1833, p. 186, pl. 6, fig. 201.
Ancilla lymneoides Con., Proc. Ac. Nat. Sci., 1865, p. 30.
Monoptygma lymneoides Con., Am. Jr. Conch., 1865, p. 23.

maclurii Con.

Ranella maclurii Con., Foss. Sh. &c., 1835, p. 55, pl. 18, fig. 9.
Gyrineum maclurii Con., Proc. Ac. Nat. Sci., 1854, p. 31.
Ranellina maclurii Con., Am. Jr. Conch., 1865, p. 21.

magna Lea

Nucula magna Lea, Cont. to Geol., Dec., 1833, p. 197, pl. 6, fig. 211.
Nuculana magna Con., Am. Jr. Conch., 1865, p. 13.

magnifica Con.

Nucula magnifica Con., Foss. Sh. Tert. Form., 1833, p. 37.
Nucula sedgewickii Lea, Cont. to Geol., Dec., 1833, p. 79, pl. 3, fig. 58.

magnocostatus Lea

Fusus magnocostatus Lea, Cont. to Geol., Dec., 1833, p. 147, pl. 5, fig. 150.

Syn. of *F. bellus* Con., which see.

magnoplicatus H. C. Lea

Actæon magnoplicatus H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 94, pl. 1, fig. 5.

Syn. of *A. melanellus* Lea, which see.

magno-umbilicata Lea

Natica magno-umbilicata Lea, Cont. to Geol., Dec., 1833, p. 109, pl. 4, fig. 94.

mamma Lea

Natica mamma Lea, Cont. to Geol., Dec., 1833, p. 109, pl, 4, fig. 95.

N. minima Lea, *idem*, p. 107. A young specimen.

N. ætites Con.

mantelli Con.

Murex mantelli Con., Jr. Ac Nat. Sci., vol. 7, 1834, p. 154.

M. mantelli Con., Amer. Jour. Conch., vol. 1, 1865, p. 210, pl. 20, fig. 11.

mantelli Lea.

Plicatula mantelli Lea, Cont. to Geol., Dec., 1833, p. 89, pl. 3, fig. 68.

Incorrectly written *mantilli* in the work just cited.

Syn. of *P. filnmentosa* Con.

margaritaceum Con.

Stalagmium margaritaceum Con., Foss. Sh. Tert. Form., 1833, p. 39.

Myoparo costatus Lea, Cont. to Geol., Dec., 1833, p. 74, pl. 2, fig. 51.

Type of *S. margarstacea* is lost.

media Lea

Nucula media Lea, Cont. to Geol., Dec., 1833, p. 83, pl. 3, f. 62.

N. equalis Con., Foss. Sh. Tert. Form., Nov., 1833, p. 46.

Nuculana equalis Con., Amer. Jr. Conch., 1865, p. 13.

Conrad's description is so imperfect that Lea's name shotld hold.

melanellus Lea

Acteon melanellus Lea., Cont. to Geol., 1833, p. 113, pl. 4, f. 99.

A. striatus Lea is probably a fragment of *melanellus*.

minima Lea

Cytherea minima Lea, Cont. to Geol., 1833, p. 66, pl. 2. f. 45.

minima Lea

Mitra minima Lea, Cont. to Geol., Dec., 1833, p. 168, pl. 6, f. 175.
This may be the young of *M. eburnea* H. C. Lea, but the latter has no twisted columellar plait.

minima Lea

Natica minima Lea, Cont. to Geol., Dec., 1833, p. 107, pl. 4, fig. 91.
Young of *N. mamma* Lea.

minima Lea

Oliva minima Lea, Cont. to Geol., Dec., 1833, p. 184, pl. 6, fig. 200.
This is a young *Marginella.*

minima H. C. Lea

Pasithea minima H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 92, pl. 1, fig. 1.
This is a small *Eulima.*

minor Lea

Astarte minor Lea, Cont. to Geol., Dec., 1833, p. 63, pl. 2, f. 38.

minor Lea

Fusus minor Lea, Cont. to Geol., Dec., 1833, p. 151, pl. 5, f. 158.
Syn. of *F. prorutus* Con., which see.

minor Lea

Natica miuor Lea, Cont. to Geol., 1833, p. 107, pl. 4, fig. 90.
Syn. of *N. eminula* Con., which see.

minor Lea

Pectunculus minor Lea, Cont. to Geol., Dec., 1833, p. 77, pl. 3, fig. 54.
Syn. of *P. declivus* Con.

minutissima Lea

Astarte minutissima Lea, Cont. to Geol., 1833, p. 64, pl. 2, fig. 39.
Pteromeris minutissima Con., Amer. Jr. Conch., 1865, p. 9.

modesta Con.

Lucina modesta Con., Am. Jr. Sci., vol. 1, 1846, p. 403, pl. 4, fig. 13.
Syn. of *L. papyracea* Lea.

monilifera Lea

Pleurotoma monilifera Lea, Cont. to Geol., Dec., 1833, p. 133, pl.

4, fig. 126.
The young of *depygis* Con.

monilifera H. C. Lea

Turritella monilifera H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 97, pl. 1, fig. 11.

mortoni Con.

Cytherea mortoni Con., Jr. Ac. Nat. Sci., vol. 7, 1834, p. 150; pl. 20, fig. 1 of Harris's republication of Foss. Sh.,&c.

mortonii Lea

Fusus mortonii Lea, Cont. to Geol., Dec., 1833, p. 145, pl. 5, fig. 145.

moulinsii Lea

Gratelupia moulinsii Lea, Cont. to Geol., 1833, p. 59, pl. 2, f. 33.
Syn. of *Cytherea hydana* Con.

multiplicata H. C. Lea

Terebra multiplicata H. C. Lea, Am. Jr. Sci., 1840, vol. 40, p. 101, pl. 1, fig. 19.
Syn. of *Buccinum amœnum* Con.,which see.

multiplicata Lea

Cancellaria multiplicata Lea, Cont. to Geol., 1833, p. 139, pl. 5, fig. 135.
Most probably the young of *C. alveata* Con.

murchisonii Lea

Corbula murchisonii Lea, Cont. to Geol., Dec., 1833, p. 46, pl. 1, fig. 13.
Syn. of *C. oniscus* Con.

nana Lea

Egeria nana Lea, Cont. to Geol., Dec., 1833, p. 55, pl. 1, fig. 26.

nanus Lea

Fusus nanus Lea, Cont. to Geol., Dec., 1833, p. 150, pl. 5, f. 155.

nassula Con.

Cerithium nassula Con., Jr. Acad. Nat. Sci., vol. 7, 1834, p. 156; and new ser., vol. 1, 1848, pl. 14, fig. 29.
Cerithiopsis nassula Con., Amer. Jr. Conch., 1865, p. 29.

nassula Con.

Scalaria nassula Con., Foss. Sh. Tert. Form., Sept., 1833, p. 31.
This will probably prove to include *C. carinata*, *quinquefasciata*. *claibornensis* and *bella*.

nasuta Con.

Corbula nasuta Con., Foss. Sh. Tert. Form., Sept., 1833, p. 38; pl. 19, fig. 4 of Harris's republication.

C. nasuta Con., Am. Jr. Sci., vol. 1, 1846, p. 398, pl. 4, fig. 4.
Syn. of *C. alabamiensis* Lea, which see.

naticoides Lea

Turbo naticoides Lea, Cont. to Geol., Dec., 1833, p. 125, pl. 4, fig. 114.
See *N. eborea* Con.

Dillwynella naticoides Dall, Trans. Wag. Fr. Inst. Sci., vol. 3, 1893, p. 418, pl. 18, fig. 3.

nicklinii Lea

Astarte nicklinii, Cont. to Geol., Dec., 1833, p. 61, pl. 2, fig. 35.
Syn. of *A. tellinoides* Con.

nitens Lea

Egeria nitens Lea, Cont. to Geol., Dec., 1833, p. 51, pl. 1. f. 19.

Abra nitens Con., Amer. Jr. Conch., 1865, p. 5.

Planaria nitens Lea, Cont. to Geol., Dec., 1833, p. 124, pl. 4, fig. 113.

nitens Lea

Turbo nitens Lea, Cont. to Geol., 1833, p. 125, pl. 4, fig. 115.

Solarorbis nitens Con., Amer. Jr. Conch., 1865, p. 30.

Calliostoma nitens Dall, Tr. Wag. Free Inst. Sci., vol. 3, 1893, p. 400, pl. 22, fig. 30.

notata Lea

Pasithea notata Lea, Cont. to Geol., Dec., 1833, p. 101, pl, 4. fig. 80.

nuperus Con.

Cassis nuperus Con., Foss. Sh Tert. Form., Nov., 1833, p. 46.

Buccinum sowerbii Lea, Cont. to Geol., Dec., 1833, p. 164, pl. 5, fig. 169.

Semicassis nuperus Con., Amer. Jr. Conch., vol., 1, 1865, p. 26.

nupera Con.

Pleurotoma nupera Con., Foss Sh. Tert. Form., 1833, p. 46; 2d. ed., p. 51, pl. 17, fig. 16.

Pl. sayi Lea, Cont. to Geol., Dec., 1833, p. 133, pl. 4, fig. 125, (young.)

nuttali Con.

Cytherea nuttali Con., Jr. Acad. Nat. Sci., vol. 7, 1834, p. 149.
Pl. 19, fig. 1 of Harris's republication.

obliqua Lea

Pectunculus obliqua Lea, Cont. to Geol., Dec., 1833, p. 78, pl. 3, fig. 57.

Syn. of *P. aviculoides* Con., which see.

obliqua Lea

Pleurotoma obliqua Lea, Cont. to Geol., Dec., 1833, p. 136, pl. 4, fig. 131.

obruta Con.

Turritella obruta Con., Foss. Sh. Tert. Form., Nov., 1833, p. 45; 2d. ed., p. 40, pl. 15, fig. 12.

Turritella lineata Lea, Cont. to Geol., Dec., 1833, p. 130, pl. 4, fig. 121.

Mesalia obruta Con.

oniscus Con.

Corbula oniscus Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 341; pl. 19, f. 3, of Harris's republication of Foss. Sh. Tert. Form.

C. oniscus Con., Amer. Jr. Sci., vol., 1, 1846, p. 398, pl. 4, fig. 3.

opulenta Con.

Nucula opulenta Con., Foss. Sh. Tert. Form., Nov., 1833, p. 46.

Nuculana opulenta Con., Amer. Jr. Conch., vol. 1, 1865, p. 13.

ornatus Lea

Fusus ornatus Lea, Cont. to Geol., Dec., 1833, p. 148, pl. 5, fig. 152.

Probably a variety of *F. limulus* Con.

ornatum Lea

Solarium ornatum Lea, Cont. to Geol., Dec., 1833, p. 120, pl. 4, fig. 108.

ovalis Lea

Egeria ovalis Lea, Cont. to Geol., 1833, p. 54, pl. 1, fig. 25, (not 24.)

ovata Lea

Marginella ovata Lea, Cont. to Geol., Dec., 1833, p. 179, pl. 6, fig. 191.

Syn. of *M. larvata* Con., which see.

ovula Lea

Nucula ovula Lea, Cont. to Geol., 1833, p. 80, pl. 3, fig. 59.

pachyleurus Con.

Fusus pachyleurus Con., Jr. Ac. Nat. Sci., vol. 8, 1841, p. 190; *ibid.*, vol. 1, 2d. series, pl. 14, fig. 25.

Clavella pachyleurus Con., Am. Jr. Conch., vol. 1, 1865, p. 18.

pactilis Con.

Mitra pactilis Con., Foss. Tert. Form., Nov., 1833, p. 46; 2d ed. p. 43, pl. 16, fig. 21.
Voluta dubia H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 103, pl. 1, fig. 23.
Lapparia pactilis Con., Amer. Jr. Conch., 1865, p. 24.

pandata Con.

Lucina pandata Con., Am. Jr. Sci., 1833, vol. 23, p. 343.
L. pandata Con., Foss. Sh. Tert. Form., Nov., 1833. p. 40.
L. compressa Lea, Cont. to Geol., Dec., 1833, p. 55, pl. 1, f. 27.

papillatus Con.

Fusus papillatus Con., Foss. Sh. Tert. Form., Sept., 1833, p. 29; 2d ed., p. 53, pl. 18, fig. 3.
Papillina papillata Con., Am. Jr. Conch., 1865, p. 17.

papyracea Lea

Lucina papyracea Lea, Cont. to Geol., 1833, p. 58, pl. 1, fig. 31.
L. modesta Con., Am. Jr. Sci., vol. 1, 1846, p. 403, pl. 4, fig. 13.

papyria Con.

Lutraria papyria Con., Foss. Sh. Tert. Form., Nov., 1833, p. 41; pl. 19, fig. 7 of Harris's reprint.
Mactra dentata Lea, Cont. to Geol., Dec., 1833, p. 41, pl. 1, f. 9.
L. papyria Con., Amer. Jr. Sci. vol. 1, 1846, p. 216, pl. 1, fig. 8.
Pteropsis papyria Con., Jr. Ac. Nat. Sci., vol. 4, 1860, p. 296.

papyria Con.

Tellina papyria Con., Foss. Sh. Tert. Form., Nov., 1833, p. 41.
T. papyria Con., Amer. Jr. Sci., vol. 1, 1846, p. 399, pl. 4, fig. 7.

parilis Con.

Mactra parilis Con., Foss. Sh. Tert. Form., Nov., 1833, p. 42; pl. 19, fig. 8 of Harris's reprint.
M. pygmæa Lea, Cont. to Geol., Dec. 1833, p. 44; pl. 1, fig. 11.
M. parilis Con., Am. Jr. Sci., vol. 1, 1846, p. 217, pl. 1, fig. 6.

parkinsonii Lea

Voluta parkinsonii Lea, Cont. to Geol., Dec., 1833, p. 175, pl. 6, fig. 184.
Syn. of *Turbinella pyruloides* Con.

parva Lea

Astarte parva Lea, Cont. to Geol., Dec., 1833, p. 63, pl. 2, f. 37.

parvum H. C. Lea

Buccinum parvum H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 100, pl. 1, fig. 17.

Allied to *Strombina*.

parva Lea

Cancellaria parva Lea, Cont. to Geol., 1833, p. 142, pl. 5, f. 141.

parvus H. C. Lea

Conus parvus H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 103, pl. 1, fig. 24.

Young of *C. sauridens* Con.

parvus Lea

Fusus parvus Lea, Cont. to Geol., Dec., 1833, p. 151, pl. 5, fig. 157.

Syn. of *F. prorutus* Con., which see.

parva Lea

Natica parva Lea, Cont. to Geol., Dec., 1833, p. 106, pl. 4, f. 89.

Variety of *N. eminula* Con., which see.

parva H. C. Lea

Turbo parva H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p, 95 pl. 1, fig. 8. An immature specimen.

parva Lea

Venericardia parva Lea, Cont. to Geol., 1833, p. 70, pl. 2, f. 49.

parva Lea

Voluta parva Lea. Cont. to Geol., Dec., 1833, p. 173, pl. 6, fig. 181.

Syn. of *V. petrosa* Con., which see.

pectuncularis Lea

Nucula pectuncularis Lea, Cont. to Geol., Dec., 1833, p. 81, pl. 3, fig. 60.

Probably young of *P. decisus* Con.

penita Con.

Pyrula penita Con., Foss. Sh. Tert. Form., 1833, p. 32; 2d ed., pl. 15, fig. 6, as *P. tricarinata* Desh.

P. elegantissima Lea, Cont. to Geol., Dec., 1833, p. 155, pl. 5, fig. 161.

P. cancellata Lea, *idem*. p. 154, pl. 5, fig. 160.

Sycotypus penitus Con., Proc. Ac. Nat. Sci., 1854, p. 31.

perexilis Con.

Mitra perexilis Con., Foss. Sh. Tert. Form., 1833, p. 46; 2d ed. pl. 16, fig. 7.

perexilis Con.

Obeliscus perexilis Con., Amer. Jour. Conch., vol. 1, 1865, p. 144;

p. 211, pl. 20, fig. 2.
Syn. of *Actæon pygmæus.*

perlatum Con.

Buccinum perlatum Con., Foss. Sh. Tert. Form., Nov., 1833, p. 45.

perlatus Con.

Fusus perlatus Con., Foss. Sh. Tert. Form., 2d. ed., p. 54, pl. 18, fig. 5.
Strepsidura perlata Con.

perovata Con.

Ampullaria perovata Con., Proc. Ac. Nat. Sci., vol. 3, p. 21.
Lupia perovata Con., Amer. Jr. Conch., vol., 1, 1865, p. 27.
Amauropsis perovata Con., Acad. collection.
Polynices (*Amauropsis*) *perovatus* Dall, Tr. Wag. Free Inst. Sci., vol. 3, 1893, p. 377.

perovata Con.

Cytherea perovata Con., Foss. Sh. Tert. Form., Sept., 1833, p. 37; pl. 20, fig. 4 of Harris's republication.
Cytherea comis Lea, Cont. to Geol., Dec., 1833, p. 66, pl. 2, f. 41.

perplanus Con.

Pectunculus perplanus Con., Jr. Ac Nat. Sci., vol. 7, 1834, p. 134.
Syn. of *P. ellipsis* Lea (young).

petricoloides Lea

Byssomia petricoloides Lea, Cont. to Geol., Dec., 1833, p. 48, pl. 1, fig. 16.

petrosa Con.

Voluta petrosa Con., Foss. Sh. Tert. Form., Sept., 1833, p. 29; 2d. ed. p. 41, pl. 16, fig. 2.
Voluta vanuxemi Lea, Cont. to Geol., Dec., 1833, p. 173, pl. 6, fig. 182.
Voluta parva Lea, *ibid*, p. 173, pl. 6, fig. 181.
Volutilithes petrosus Con., Proc. Ac. Nat, Sci., 1854, p. 31.

phillipsii Lea

Oliva phillipsii Lea, Cont. to Geol., Dec. 1833, p. 184, pl. 6, fig. 199.
Small short form of *O. alabamensis* Con.

pincera Lea

Ostrea pincera Lea, Cont. to Geol., 1833, p. 92, pl. 3, fig. 73.
Young of *O. alabamiensis* Lea, which see.

plana Lea

Delphinula plana Lea, Cont. to Geol., Dec., 1833, p. 117, pl. 4,

104.
Syn. of *Solarium exacuum* Con., which see.

plana Lea

Egeria plana Lea, Cont. to Geol. 1833, p. 54, pl. 1, fig. 24 (not 25)
Tellina plana Con., Amer. Jr. Sci., vol. 1, 1846, p. 400, pl. 4, f. 6.

plana Con.

Nucula plana Lea, Cont. to Geol., Dec., 1833, p. 199, pl. 6, fig. 213.

planicosta Con.

Cardita planicosta (Lam.) Con., Foss. Sh. Tert. Form., 1832, p. 20.

planulata Lea

Scalaria planulata Lea, Cont. to Geol., Dec., 1833, p. 115, pl. 4, fig. 102.
S. venusta H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 95, pl. 1, fig. 7.
Syn. of *S. sessilis* Con., which see.

planulatus H. C. Lea

Trochus planulatus H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 96, pl. 1, fig. 9.

plicata Lea

Anolax plicata Lea, Cont. to Geol., Dec., 1833, p. 181, pl. 6, fig. 194.
Type lost.
Young of *Ancillaria scamba* Con.

plicata Lea

Cancellaria plicata Lea, Cont. to Geol., Dec., 1833, p. 139, pl. 5, fig. 136,
C. lirata Con., Am. Jr. Conch., vol. 1, 1865, p. 145.

plicata Lea

Marginella plicata Lea, Cont. to Geol., Dec., 1833, p. 178, pl, 6, fig. 189.

plicata Lea

Nucula plicata Lea, Cont. to Geol., Dec., 1833, p. 85, pl. 3, f. 64.
Syn. of *N. bella* Con.

plicata Lea

Fasciolaria plicata Lea, Cont. to Geol., 1833, p. 143, pl. 5, f. 142.
Turbinella fusoides H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 98,

pl. 1, fig. 14.
Latirus plicatus Con., Am. Jr. Conch., vol. 1, 1865, p. 23.

polygyra Con.

Terebra polygyra Con., Jour. Ac. Nat. Sci., Phila., vol. 7, 1834, p. 156.

pomilius Con.

Acteon pomilius Con., Foss. Sh. Tert. Form., 1833, p. 45.
Acteon punctatus Lea, Cont. to Geol., Dec., 1833, p. 111, pl. 4, fig. 96.

pomilia Con.

Lucina pomilia Con., Foss. Sh. Tert. Form., 1833, p. 40.
L. impressa Lea, Cont. to Geol., Dec., 1833, p. 57, pl. 1, fig. 30.
L. pomilia Con., Am. Jr. Sci., vol. 1, 1846, p. 402, pl. 4, fig. 17.

poulsoni Con.

Cytherea poulsoni Con., Foss. Sh. Tert. Form., Sept., 1833, p. 36; pl. 20, fig. 7 of Harris's reprint.
C. globosa Lea, Cont. to Geol., Dec., 1833, p. 65, pl. 2, fig. 40.

prætenuis Con.

Ancillaria prætenuis Con., labelled specimen. See *A. tenera*.

prætenuis Con.

Mactra prætenuis Con., Foss. Sh. Tert. Form., 1833, p. 42; pl. 19, fig. 9 of Harris's reprint.

prætenuis Con.

Turbinella prætenuis Con. ,Foss. Sh. Tert. Form., Nov,. 1833, p. 45.
Caricella prætenuis Con., Foss. Sh. Tert. Form., 2d ed., 1835, p. p. 44, pl. 17, fig. 1.
Voluta striata Lea, Cont. to Geol., Dec., 1833, p. 174, pl. 6, f. 183.

prisca Con.

Turbinella prisca Con., Foss. Sh. Tert. Form., 1833, p. 45; 2d ed. p. 43. pl. 16, fig. 9 as *Voluta*
Syn. of *Mitra doliata* Con., which see.

profunda Con.

Amphidesma profunda Con., append. to Morton's Synopsis of Organic Remains, p. 8. Also Harris's reprint of Foss. Sh. &c. pl. 19, fig. 4.

prorsum Con.

Buccinum prorsum Con., Foss. Sh. Tert. Form., 1833, p. 45.
Lævibuccinum prorsum Con., Amer. Jr. Conch., vol. 1, p. 211, pl. 20, fig. 17.

proruta Con.

Astarte proruta Con., Foss. Sh. Tert. Form., Sept., 1833, p. 38.
Type lost.

prorutus Con.

Fusus prorutus Con., Foss. Sh. Tert. Form., Nov., 1833, p. 43.
Fusus parvus Lea, Cont. to Geol., Dec, 1833, p. 151, pl. 5, fig. 157.
F. minor Lea, *idem*, fig. 158.
Pleurotoma proruta Con., Foss. Sh. &c., 1835, p. 51, pl. 17, f. 15.
Leiorhynus crassilabris Gabb, Jr. Ac. Nat. Sci., 2d ser., vol. 4, 1860, p. 402, pl. 67, fig. 60.
Leiorhynus prorutus Con., Amer. Jr. Conch., 1865, p. 30.

proscissus Con.

Fusus proscissus Con., Foss. Sh. Tert. Form., 1833, p. 43.
Type lost.

protexta Con.

Crassatella protexta Con., Foss. Sh. Tert. Form., 1832, p. 22, pl. 8, fig. 2,
C. protexta Con., Amer. Jr. Sci., vol. 1, 1846, pl. 3, fig. 4.

protextus Con.

Fusus protextus Con., Foss. Sh. Tert. Form., 1833, p. 43.
F. protextus Con., Foss. Sh. &c., 2d. ed., p. 54, pl. 18, fig. 7.
F. (Turrispira) protexta of the Acad. coll.
This is a *Clavilithes.*

pulcher Lea

Fusus pulcher Lea, Cont. to Geol., 1833, p. 144, pl. 5, fig. 144.
Syn. of *Fusus thalloides* Con.

pulcherrima H. C. Lea

Cancellaria pulcherrima H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 99, pl. 1, fig. 15.
This is probably a good species; it is very rough, with two columellar plaits.

pulcherrima Lea

Nucula pulcherrima Lea, Cont. to Geol., Dec., 1833, p. 84, pl. 3, fig. 63.
One specimen of the so-called types is the young of *opulenta.*

punctatus Lea

Acteon punctatus Lea, Cont. to Geol., 1833, p. 111, pl. 4 fig. 96.
Syn. of *A. pomilius* Con.

pygmæus Lea

Acteon pygmæus Lea, Cont. to Geol., Dec., 1833, p. 114, pl. 4, fig. 101.
Obeliscus perexilis Con., Am. Jr. Conch., 1865, p. 144 & 211, pl. 20, fig. 2.

pygmæa Lea

Hipponyx pygmæa Lea, Cont. to Geol., Dec., 1833, p. 95, pl. 3, fig. 75.
Cochlolepas pygmæus Con., Am. Jr. Conch., 1865, p. 33.

pygmæa Lea

Mactra pygmæa Lea, Cont. to Geol., Dec., 1833, p. 44. pl. 1, fig. 11.
Syn. of *Mactra parilis* Con.

pyramidatum H. C. Lea

Triton pyramidatum H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 99, pl. 1, fig. 16.
This seems to be a good species; its striæ are much coarser than those of *Ranella maclurii* which in some respects it resembles.

pyruloides Lea

Monoceros pyruloides Lea, Cont. to Geol., Dec., 1833, p. 161, pl. 5, fig. 166.
Syn. of *Monoceros vetustus* Con., which see.

pyruloides Con.

Turbinella pyruloides Con., Foss. Sh. Tert. Form., 1832, p. 24, pl. 10, fig. 1.
Voluta parkinsonii Lea., Cont. to Geol., 1833, p. 175, pl. 6, fig. 184.
Caricella pyruloides Con., Foss. Sh. &c., 1835, p. 44.

quinquefasciata Lea

Scalaria quinquefasciata Lea, Cont. to Geol., 1833, p. 116.
Probably synonym of *S. nassula* Con.

rannelloides Con.

Fusus rannelloides Con., Foss. Sh. Tert. Form., 1833, p. 43.
Type lost.

raphanoides Con.

Fusus raphanoides Con., Jr. Ac. Nat. Sci., vol.7, 1834, p. 144.
F. raphanoides Con., Foss. Sh. Tert. Form., 1835, p. 54, pl. 18, fig. 8.
This is probably the young of *pachyleurus*. Both are *Clavilithes*.

raveneli Con.

Tellina raveneli Con., Am. Jr. Sci., vol. 1, 1846, p. 400.

rectilinearis Con.

Erycina rectilinearis Con., Foss. Sh. Tert. Form., 1833, p. 42; pl. 19, fig. 10 of Harris's republication.
Triquetra rectilinearis Con., Amer. Jr. Sci., vol. 1, 1846, p. 218, pl. 1, fig. 8.
Mactropsis rectilinearis Con., Proc. Ac. Nat. Sci., 1865, p. 30.

recurva Lea

Astarte recurva Lea. Cont. to Geol., Dec., 1833, p. 61, pl. 2, fig. 34.
Syn. of *Lucina dolabra* Con.

rhomboidella Lea

Arca rhomboidella Lea, Cont. to Geol., 1833, p. 74, pl. 2, fig. 52.

rotella Lea

Orbis rotella Lea, Cont. to Geol. 1833, p. 123, pl. 4, fig. 112.

rotunda Lea

Egeria rotunda Lea, Cont. to Geol., Dec., 1833, p. 50, pl. 1, fig. 17.
Syn. of *Astarte ungulina* Con., which see.

rotunda Lea

Lucina rotunda Lea, Cont. to Geol., Dec., 1833, p. 56, pl. 1, f. 28.
Syn. of *L. symmetrica* Con.

rotunda Lea

Venericardia rotunda Lea, Cont. to Geol., 1833, p. 70, pl. 1, f. 48.

rugatina Con.

Pleurotoma rugatina Con., "Proc. Ac. Nat. Sci., 1865", — Con. Labelled specimen in Phila. Ac. coll.

rugosa Lea

Pleurotoma rugosa Lea, Cont. to Geol., 1833, p. 136, pl. 4, f. 130.

sulcata Lea

Astarte sulcata Lea, Cont. to Geol., 1833, p. 62, pl. 2, fig. 36.
Syn. of *A. tellinoides* Con., which see.

sagenum Con.

Buccinum sagenum Con., Foss. Sh. Tert. Form., 1833, p. 34.
Nassa cancellata Lea, Cont. to Geol., Dec., 1833, p. 165, pl. 5, fig. 170.
Buccitriton sagenum Con., Amer. Jr. Conch., vol. 1, 1865, p. 20.

salebrosus Con.

Fusus salebrosus Con., Jr. Ac Nat. Sci., vol. 7, 1834, p. 145.
Fusus salebrosus Con., Foss. Sh. Tert. Form., 1835, p. 56, pl. 18, fig. 13.

Doubtless the young of *protextus*.

sauridens Con.

Conus sauridens Con., Foss. Sh. Tert. Form., 1833, p. 33; pl. 15, fig. 7 of 2d ed.
C. claibornensis Lea, Cont. to Geol., Dec., 1833, p. 186.
C. parvus H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 103, pl. 1, fig. 24.

sayana Con.

Voluta sayana Con., Foss. Sh. Tert. Form., 1833, p. 29; pl. 16, fig. 1 of 2d ed.
V. defrancii Lea, Cont. to Geol., Dec., 1833, p. 171, pl. 6, fig. 179.
V. gracilis Lea, *ibid.*, p. 172, pl. 6, fig. 180.
Volutilithes sayanus Con., Proc. Ac. Nat. Sci., 1854, p. 31.

sayi Lea

Pleurotoma sayi Lea, Cont. to Geol., Dec., 1833, p. 133, pl. 4, fig. 125.

Young of *P. nupera* Con., which see.

scamba Con.

Ancillaria scamba Con., Foss. Sh. Tert. Form., 1832, p. 25, pl. 10, fig. 4.
Anolax plicata Lea., Cont. to Geol., 1833, p. 181, pl. 6, fig. 194.
Ancilla scamba Con. Proc. Ac. Nat. Sci., 1854, p. 30.
Ancillopsis scamba Con.

scandula Con.

Tellina scandula Con., Jr. Ac. Nat. Sci., vol. 7, 1834, p. 132.
T. scandula Con., Amer. Jr. Sci., vol., 1, 1846, p. 400, pl. 4, f. 8.

scrobiculatum Con.

Solarium scrobiculatum Con., Foss. Sh. Tert. Form., 1833, p. 44.
S. patulum, Foss. Sh. Tert. Form., 2d ed., 1835, p. 49, pl. 17, fig. 9.
Architectonica scrobiculata Con., Am. Jr. Conch., vol. 1, 1865, p. 30.

sculpturata Lea

Cancellaria sculpturata Lea, Cont. to Geol., Dec., 1833, p. 140, pl. 5, fig. 137.

Syn. of *C. alveata* Con.

secale Lea

Pasithea secale Lea, Cont. to Geol., 1833, p. 100, pl. 4, fig. 79.

sedgewickii Lea

Nucula sedgewickii Lea. Cont. to Geol., Dec., 1833, p. 79, pl. 3, fig. 58.

Syn. of *Nucula magnifica* Con.

sellæformis Con.

Ostrea sellæformis Con., Foss. Sh. Tert. Form., 1832, p. 27, pl. 13.

O. radians Con., *ibid.*, p. 27, pl. 13, fig. 1.

It is very doubtful whether a specimen of this species has ever been found in the Claiborne sand. A very closely related form, *O. divaricata*, is occasionally met with here and above but *sellæformis* seems to be more particularly a Lower Claiborne form. It is particularly abundant in the calcareous layers from 10 to 60 feet beneath the sand bed.

semen Lea

Marginella semen Lea, Cont. to Geol., 1833, p. 178, pl. 6, f. 190.

semen Lea

Nucula semen Lea, Cont. to Geol., 1833, p. 200, pl. 6, f. 214.

semilunata Lea

Natica semilunata Lea, Cont. to Geol., Dec., 1833, p. 108, pl. 4, fig. 93.

semilunata Lea

Ostrea semilunata Lea, Cont. to Geol., Dec., 1833, p. 90, pl. 3, fig. 69.

Syn. of *O. alabamiensis*, which see.

septemnarius Con.

Murex septemnarius Con., Jr. Ac. Nat. Sci., vol. 7, 1834, p. 154.

Type ?

sessilis Con.

Scalaria sessilis Con., Foss. Sh. Tert. Form., Nov., 1833, p. 45.

S. planulata Lea, Cont. to Geol., Dec., 1833, p. 115, pl. 4, fig. 102.

S. venusta H. C. Lea, Amer. Jr. Sci., vol. 40, 1840, p. 95, pl. 1, fig. 7.

sexangulus Con.

Fusus sexangulus Con., Jr. Acad. Nat. Sci., vol. 7, 1834, p. 144.

Type ?

Syn. of *Murex engonatus fide* Con.

sillimani Con.

Tellina sillimani Con., Amer. Jr. Sci., vol. 1, 1846, p. 399. pl. 4, fig. 9.

sillimani Lea

Venericardia sillimani Lea, Cont. to Geol., Dec., 1833, p. 69, pl. 2, fig. 47.

Variety of *alticostata* Con., which see.

simplex Lea

Teredo simplex Lea, Cont. to Geol., Dec., 1833, p. 38, pl. 1, f. 6.

smithii Lea

Pyrula smithii Lea, Cont. to Geol., Dec., 1833, p. 155, pl. 5, fig. 162.

Syn. of *Melongena alventa* Con., which see.

solitarium Con.

Cerithium solitarium Con., Jr. Acad. Nat. Sci., vol. 7, 1834, p. 147: new ser., vol. 1, 1848, pl. 14, fig. 28. Type ?

Cerithiopsis solitaria Con., Amer. Jour. Conch.,vol. 1, 1865, p. 29.

sowerbii Lea

Buccinum sowerbii Lea, Cont. to Geol., Dec., 1833, p. 164, pl. 5, fig. 169.

Syn. of *Cassis nuperus* Con., which see.

squamulosa Con.

Serpula squamulosa Con., Jr. Ac. Nat. Sci., vol. 7, 1834, p. 149. Type?

stalagmium Con.

Solarium stalagmium Con., Foss. Sh. Tert. Form., 1833, p. 44; 2d ed., p. 48, pl. 17, fig. 6.

S. elegans Lea, Cont. to Geol., Dec., 1833, p. 121, pl. 4, fig. 109,

staminea Con.

Ancillaria staminea Con., Foss. Sh. Tert. Form., 1832, p. 25, pl. 10, fig. 5.

Olivula staminea Con., *ibid.* and Amer. Jr. Conch., vol., 1, 1865, p. 22.

stamineus Con.

Fusus stamineus Con., Foss. Sh. Tert. Form., 1833, p. 43; pl. 18, fig. 14 of 2d ed.

stamineus Con.

Pectunculus stamineus Con., Amer. Jr. Sci., vol. 23, Jan., 1833, p. 342.

P. broderipii Lea, Cont. to Geol., Dec., 1833, p. 76, pl.3, f. 53.

staminea Con.

Scalaria staminea Con., Jr. Ac. Nat. Sci., vol. 4, p. 294.

st. hillairii Lea

Bulla st. hillairii Lea, Cont. to Geol., Dec, 1833, p. 98, pl. 4, fig. 78.

Syn. of *Volvaria galba* Con., which see.

striatus Lea

Acteon striatus Lea, Cont. to Geol., 1833, p. 114, pl. 4, fig. 100.

Probably a fragment of *A. melanellus* Lea.

striatum Lea

Cerithium striatum Lea, Cont. to Geol., 1833, p. 131, pl. 4, fig. 122.

Syn. of *Mesalia vetusta* Con., which see.

striata Lea

Natica striata Lea, Cont. to Geol., Dec., 1833, p. 105, pl. 4, fig. 88.

Syn. of *Sigaretus bilix* Con.

striata Lea

Pasithea striata Lea, Cont. to Geol., 1833, p. 102, pl. 4, fig. 83.

Actæonima striata (Lea) Con., Amer. Jr. Conch., 1865, p. 147, pl 11, fig. 2.

striata Lea

Tuba striata Lea, Cont. to Geol., Dec., 1833, p. 128, pl. 4, fig. 117.

Syn. of *Littorina striata* Con.. which see.

striata Lea

Voluta striata Lea, Cont. to Geol., Dec., 1833, p. 174, pl. 6, fig. 183.

Syn. of *Turbinella prætenuis* Con., which see.

subcrassa Lea

Cytherea subcrassa Lea, Cont. to Geol., 1833, p. 67, pl. 2, fig. 43.

C. subcrassa (Lea) Con., Harris's rpublication of Foss. Sh. &c., pl. 20, fig. 6.

subequalis Con.

Pleurotoma subequalis Con., Foss. Sh. Tert. Form., 1835, p. 51, pl. 17, fig. 18.

subglobosa Con.

Ancillaria subglobosa Con., Foss. Sh. &c., 1832, p. 25, pl. 10, fig. 3.

Ancilla subglobosa Con., Proc. Ac. Nat. Sci., 1854, p. 30.

Ancillopsis subglobosa Con., Am. Jr. Conch., vol. 1, 1865, p. 22.

subtrigona Lea

Egeria subtrigonia Lea, Cont. to Geol., 1833, p. 53, pl. 1, fig. 22.
E. donacia Con., Amer. Jr. Conch., vol. 1, 1865, p. 146, pl. 11.
Conrad's specimen is slightly more inflated than Lea's.

subvexa Con.

Lucina subvexa Con., Foss. Sh. Tert. Form., Nov., 1833, p. 40.
L. subvexa Con., Am. Jr. Sci., vol. 1, 1846, p. 403, pl. 4, fig. 14.

sulcata Lea

Astarte sulcata Lea, Cont. to Geol., 1833, p. 62, pl. 2, fig. 36.
Syn. of *A. tellinoides* Con.

sulcatum Lea

Monoceros sulcatum Lea, Cont. to Geol., Dec., 1833, p. 163, pl. 5, fig. 168.
Syn. of *M. vetustus* Con., which see.

sulcata Lea

Pasithea sulcata Lea, Cont. to Geol., Dec., 1833, p. 103, pl. 4, fig. 84.

sulcata Lea

Tuba sulcata Lea, Cont. to Geol., Dec., 1833, p. 129, pl. 4, fig. 119.
Probably but a variety of *Littorina antiquata*, which see.

symmetricus Con.

Fusus symmetricus Con., Jour. Ac. Nat. Sci. Phila., vol. 7, 1834, p. 155.
Type?

symmetrica Con.

Lucina symmetrica Con., Foss. Sh. Tert. Form., 1833, p. 40.
L. rotunda Lea, Cont. to Geol., 1833, p. 56, pl. 1, fig. 28.

tabulata Con.

Pleurotoma tabulata Con., Foss. Sh. Tert. Form., 1833, p. 46; pl. 17, fig. 14 of 2d ed.
P. cœlata Lea, Cont. to Geol., Dec., 1833, p. 132, pl, 4, fig. 123.

taitii Con.

Cassis taitii Con., Jr. Ac. Nat. Sci., vol. 7, 1834, p. 145.
Semicassis taitii Con., Am. Jr. Conch., vol. 1, 1865, p. 26.

taitii Lea

Fusus taitii Lea, Cont. to Geol., 1833, p. 152, pl. 5, fig. 159.
Syn. of *Melongena armigera* Con., which see.

tellinoides Con.

Astarte tellinoides Con., Amer. Jr. Sci., vol. 23, 1833, p. 342;

pl. 19, fig. 2 of Harris's reprint of Foss. Sh. &c.
A. nicklinii Lea, Cont. to Geol., Dec., 1833, p. 61, pl. 2, fig. 35.
A. sulcata Lea, " " " p. 62, pl. 2, fig. 36.

tellinula Con.

Amphidesma tellinula Con., Amer. Jr. Sci., vol. 1, 1846, p. 397, pl. 4, fig. 5.
A. tellinula Con. is mentioned on p. 8 of the appendix to Morton's Synopsis, 1834, and is figured on p. 119 of Harris's reprint.
Abra tellinula Con., Am. Jr. Conch., vol. 1, 1865, p. 5.

tenebrosa Con.

Fissurella tenebrosa Con., Foss. Sh. Tert. Form., Sept., 1833, p. 33.
F. tenebrosa Con., *ibid.*, 2d. ed., 1835, p. 39, pl. 15, fig. 9.
F. claibornensis Lea, Cont. to Geol., Dec., 1833, p. 94, pl. 3, f. 74.

tenera Con.

Ancillaria tenera Con., Jr. Ac. Nat. Sci., Phila., vol. 7, 1834, p. 147.
A. tenera Con., Foss. Sh. Tert. Form., 1835, p. 42, pl 16, fig. 5.
Ancilla tenera Con., Proc. Ac. Nat. Sci., 1854, p. 30.
Equivalent to *A. prætenuis* Con. according to the label.

terebriformis Con.

Mitra terebriformis Con., Jr. Ac. Nat. Sci., vol. 1, 1848, p. 132, pl. 14, fig. 30.
Pyramimitra terebriformis Con., Am. Jr. Conch., vol. 1, 1865, p. 28.

tessellata Lea

Cancellaria tessellata Lea, Cont. to Geol., Dec., 1833, p. 140, pl. 5, fig. 138.

thalloides Con.

Dentalium thalloides Con., Foss. Sh. Tert. Form., Sept., 1833, p. 34.
D. thalloides Con., *ibid.*, 2d. ed., p. 39, pl. 15, fig. 10.
D. alternata Lea, Cont. to Geol., Dec., 1833, p. 34, pl. 1, fig. 2.
D. thalloides Con., Amer. Jr. Sci., vol. 1, 1846, p. 211, pl. 2, f. 2.

thalloides Con.

Fusus thalloides Con., Foss. Sh. Tert. Form., Nov., 1833, p. 43.
F. thalloides Con. *idem*, 2d. ed., p. 56, pl. 18, fig. 12.
F. pulcher Lea, Cont. to Geol., 1833, p. 144, pl. 5, fig. 144.
Exilifusus thalloides Con., Amer. Jr. Conch., vol. 1, 1865, p. 18.

thoracicus Con.

Fusus thoracicus Con., Foss. Sh. Tert. Form., 1833, p. 30; 2d. ed., p. 54, pl. 18, fig. 6.
F. decussatus Lea, Cont. to Geol., Dec., 1833, p. 145, pl. 5, fig. 146.
Lirofusus thoracicus Con., Am. Jr. Conch., 1865, p. 17.

trabeatus Con.

Fusus trabeatus Con., Foss. Sh. Tert. Form., Sept., 1833, p. 29; 2d. ed., p. 53, pl. 18, fig. 1.
F. bicarinatus Lea, Cont. to Geol., Dec., 1833, p. 146, pl. 5, fig. 147.
Levifusus trabeatus Con., Amer. Jr. Conch., vol., 1, 1865, p. 17.

transversa Lea

Venericardia transversa Lea, Cont. to Geol., Dec., 1833, p. 68, pl. 2, fig. 46.
Syn. of *V. alticostata* Con.

triangulata Lea

Egeria triangulata Lea, Cont. to Geol., 1833, p. 51, pl. 1, fig. 20.
Syn. of *Donax limatula* Con.

tricostatum Con.

Solarium tricostatum Con., Foss. Sh. Tert. Form., 1835, p. 50, pl. 17, fig. 10.
S. granulatum Lea, Cont. to Geol., Dec., 1833, p. 122, pl. 4, fig. 111.
Conrad found that Lea's name was preoccupied by Lamarck's, hence the new name.

trigonellus Con.

Pectunculus trigonellus Con., Amer. Jr. Sci., vol. 23, 1833, p. 342.
P. deltoideus Lea, Cont. to Geol., Dec., 1833, p. 77, pl. 3, fig. 55.

trigoniata Lea

Cytherea trigoniata Lea, Cont. to Geol., Dec., 1833, p. 67, pl. 2, fig. 44.
Syn. of *C. discoidalis* Con., which see.

trochiformis Lea

Infundibulum trochiformis Lea, Cont. to Geol., Dec., 1833, p. 96, pl. 3, fig. 76.
I. urticosum Con., Foss. Sh. Tert. Form., 1833, p. 32.
I. trochiformis (Lam.) Con., Foss. Sh., &c., 1835, p. 46, pl. 16, fig. 18.

turritum Lea

Dentalium turritum Lea, Cont. to Geol.. 1833, p. 35, pl. 1, fig. 3.

umbilicata Lea

Pasithea umbilicata Lea, Cont. to Geol., Dec., 1833, p. 103, pl. 4, fig. 85.
Niso umbilicata d'Orb. Prod., 2, 318, t. 92.

undata Con.

Corbis undata Con., Foss. Sh. Tert. Form., Nov., 1833, p. 41; pl. 19, fig. 6 of Harris's reprint. See Amer. Jr. Sci., vol. 1, 1846, p. 401, pl. 4, fig. 11.

According to Conrad this is equivalent to *C. distans*.

ungulina Con.

Astarte ungulina Con., Amer. Jr. Sci., vol. 23, 1833, p. 342.
Egeria rotunda Lea, Cont. to Geol., 1833, p. 50, pl. 1, fig. 17.
Mysia ungulina Con., Amer. Jr. Conch., vol. 1, 1865, p. 9.

urticosum Con.

Infundibulum urticosum Con., Foss. Sh. Tert. Form., 1833, p. 32, Syn. of *I. trochiforme* Lam., *fide* Conrad.

vanuxemi Con.

Murex vanuxemi Con., Am. Jr. Conch., vol. 1, 1865, p. 210, pl. 20, fig. 4.

vanuxemi Lea

Voluta vanuxemi Lea, Cont. to Geol., 1833, p. 173, pl. 6, fig. 182. Syn. of *V. petrosa* Con.

velata Con.

Rostellaria velata Con., Foss. Sh. Tert. Form., 1833, p. 31; pl. 15, fig. 5 of 2d ed., 1835.
R. lamarckii Lea, Cont. to Geol., 1833, p. 158, pl. 5, fig. 164.
Calyptraphorus velatus Con.

veneriformis Lea

Egeria veneriformis Lea, Cont. to Geol., Dec., 1833, p. 53, pl. 1, fig. 23.

venustus Lea

Fusus venustus Lea, Cont. to Geol., Dec., 1833, p. 146, pl. 5, fig. 148.

venusta H. C. Lea

Scalaria venusta H. C. Lea, Am. Jr. Sci., vol. 40, 1840, p. 95, pl. 1, fig. 7.

Syn. of *S. sessilis* Con.

venusta Lea

Terebra venusta Lea, Cont. to Geol., 1833, p. 167, pl. 5, fig. 173.

vetusta Con.

Melania? vetusta Con., Foss. Sh. Tert. Form., 1833, p. 35.
Proto vetusta Con., Jour. Ac. Nat. Sci. Phila., vol. 7, 1834, p. 146.
Turritella vetusta Con., 2d ed. Foss. Sh. &c., 1835, p. 40, pl. 15, fig. 13.
Cerithium striatum Lea, Cont. to Geol., Dec., 1833, p. 131, pl. 4, fig. 122.
Mesalia vetusta Con., Amer. Jr. Conch., vol. 1, 1865, p. 33.

vetustus Con.

Monoceros vetustus Con., Foss. Sh. Tert. Form., Nov. 1833. p. 44; pl. 15, fig. 3 of 2d ed., 1835.
M. pyruloides Lea, Cont. to Geol., 1833, p. 161, pl. 5, fig. 166.
M. fusiformis Lea, *idem*, p. 162, pl. 5, fig. 167.
M. sulcatum Lea, *idem*, p. 162, pl. 5, fig. 168.
Pseudoliva vetusta Con.
Sulcobuccinum (*Buccinorbis*) *vetustus* Con., Am. Jr. Conch., 1865, p. 22.

vitis Con.

Siliquaria vitis Con., Foss. Sh. Tert. Form., Sept., 1833, p. 36; pl. 17, fig. 2 of 2d ed.
S. claibornensis Lea, Cont. to Geol., 1833, p. 33, pl. 1, fig. 1.
Tenagoda vitis Con., Amer. Jr. Conch., 1865, p. 33.

Part II.— New or remarkable Claiborne sand species.

MERTRIX

Meretrix perovata, var. *aldrichi*, nov. var. Pl. 1, fig. 1.

In collecting large quantities of this species at Claiborne, one finds that it is subject to rather wide variations both as to form and surface markings. The typical and most abundant form is that figured on pl. 20 of Harris's republication of Fossil Shells &c. (*Cytherea comis* Lea). This is comparatively small, smooth, gibbous about the umbones, and cuneate posteriorly. The variety above named is on the other hand large, elliptical, and with strong concentric rugæ on the anterior and posterior but not the middle.

In the collection of the Phila. Ac. Nat. Sci., some specimens of this variety are included under "*Cytherea perovata* Con." while others are among "*C. mortoni* Con."

That *aldrichi* is only a variety of *perovata* is proven by the abundance of connecting forms.

Type. — Collection of the State Museum, Austin, Tex.

Meretrix cornelli, nov. sp. Pl. 1, fig. 5.

The specimen herewith figured is the second of the kind known to the writer; the first belongs to the U. S. National Museum and and was collected by L. C. Johnson formerly of the U. S. Geol. Survey. The species is characterized by its large size (natural in the figure), its rhomboidal form,— the obtuse angles at beak and base, the acute at either extremity,— the smooth exterior with lines only about the margins, and the plain V shaped pallial sinus.

Type. — Harris's collection.

CANCELLARIA

Cancellaria priama, nov. sp. Pl. 1, fig. 2.

This beautiful specimen (enlarged about four diameters in the figure) was collected by the author for the Texas State Museum but was broken to pieces before reaching its destination. Fortunately a camera lucida drawing had been made of it while entire and the same is herewith reproduced. The cancellation of the exterior is distinct as represented, though at the junction of transverse and vertical lines, especially towards the shoulder there should be slightly more prominent nodules. The columellar plaits, well shown in the figure are very peculiar for the genus.

CARICELLA

Caricella claibornensis Harris. Pl. 1, fig. 3.

C. claibornensis Har., Dana's Manual of Geology, 4th ed., 1895, p. 897, fig. 1489.

This species is distinguished at once from the other members of the genus by its short, stout form and the straightness of the sides of the body whorl, *i. e.*, from shoulder to tip of columella. On the latter there are four folds decreasing in strength from above downwards; the lowest is but a swelling on the columella, extending some distance up and down as shown by the figure.

Type. — Texas State Museum.

AMAUROPSIS

Amauropsis perovata Con. Pl. 1, fig. 4.

Ampullaria? perovata Con., Proc. Ac. Nat. Sci., 1846, p. 21, pl. 1, fig. 16.

See also p. 34 of this Bulletin.

Conrad's specimen and figure of this species are very imperfect. The shell substance is very thin and fragile and hence even our specimen, though perfect when collected, has lost slight fragments from its acute outer lip. Its Naticoïd affinities are beyond question.

Type.— Phila. Ac. Fig'd specimen, Harris's collection.

MESALIA

Mesalia vetusta Con. pl. 1, fig. 6.

(See p. 48 of this Bulletin).

Conrad has well remarked of this species that it is very abundant though rarely perfect. The figure he gives in his Foss. Sh. Tert. Form., 1835 is very misleading ; Lea's is better. This specimen when figured was perhaps as perfect as when first deposited. Its apex is slightly eroded. Its aperture, at least when figured, was perfect.

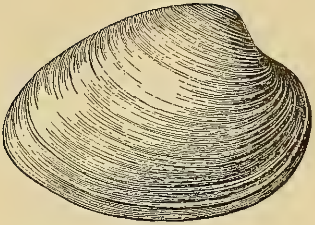
The direct ancestor of this species is clearly *M. claibornensis* of the Lower Claiborne horizon. This in turn seems to have come from "*Potamides*" *alabamiensis* Whitf., of the Lignitic. The Midway contains a large number of varietal forms of *P. alabamiensis*.

Type of the species. — Phila. Ac. Coll.

Figured specimen. — Texas State Museum.

ERRATA

Page 6, line 3; for 44, read 31.
Page 6, line 6; for 31, read 44.
Page 27, line 25; for *filnmentosa* read *filamentosa.*
Page 27, line 31; for *margarstacea* read *margaritaceum.*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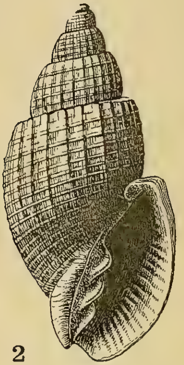
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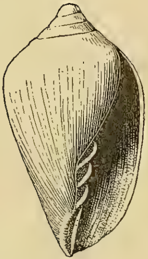
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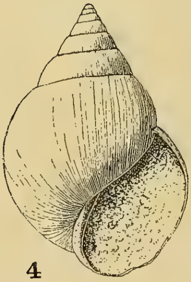
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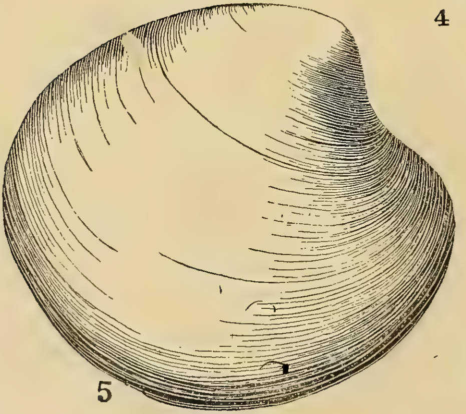
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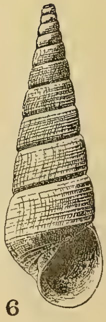
6

EXPLANATION OF PLATE 1

Fig. 1. *Meretrix perovata*, var. *aldrichi*, nov. var. . . . . Page 48.
2. *Cancellaria priama*, nov. sp. . . . . 49.
3. *Caricella claibornensis* Harris. . . . . 49.
4. *Amauropsis perovata* Conrad. . . . . 49.
5. *Meretrix cornelli*, nov. sp . . . . 49.
6. *Mesalia vetusta* Conrad. . . . . 50.

Vol. 1

BULLETINS
OF
AMERICAN PALEONTOLOGY

No. 2

NEW OR LITTLE KNOWN TERTIARY MOLLUSCA FROM ALABAMA AND TEXAS

By

T. H. Aldrich

June 24, 1895

Cornell Univ., Ithaca, N. Y.
Harris & Stoneman

Smithsonian Institution
JAN 19 1910
National Museum

NEW OR LITTLE KNOWN TERTIARY MOLLUSCA FROM ALABAMA AND TEXAS.

By

T. H. Aldrich.

The fossils described in this paper were obtained by the writer between the years 1887 and 1889, and the plates and most of the descriptions were prepared for publication early in 1890. The material, however, was never published, and since then several of the forms illustrated have been described by others. A large number of the species are from the Eocene of Alabama. They do not by any means exhaust the subject as the writer still has a large number of new species from the prolific strata of Alabama and adjoining states.

Through the kindness of Professor Gilbert D. Harris of Cornell University the writer is now enabled to publish the following descriptions.

All the types of the species herein described are in my collection unless otherwise stated.

SCAPHOPODA.

DENTALIUM.

Dentalium multannulatum, nov. sp. Pl. 1, fig. 3.

Shell strongly arcuate, transversely striated or ringed, posterior end entire ; anterior, oblique ; section oval ; substance of shell thin at the anterior end, thickened posteriorly.

Locality.—Gregg's Landing, Ala.

This species is beautifully marked with close-set annulations which seem to be slightly oblique to the axis. All the specimens found, over a dozen in number, are silicified, some showing the rings strongly, others rather faintly. The posterior orifice is almost circular in section.

Dentalium microstria Heilprin. Pl. 1, fig. 6.

This figure is given to show the form of the slit. Perfect specimens are extremely rare.

Locality.—Wood's Bluff, Ala.

CADULUS.

Since this paper was practically finished in 1889, Prof. W. H. Dall in his monumental "Contributions to the Tertiary Fauna of Florida" has given a complete review of this genus rendering the illustrations of this genus of little value. *Cadulus subcoarctatus* Gabb no doubt should be united to *C. abruptus* Ald. & M'r. A form from Gregg's Landing, Ala., differs from the type by being much more slender. It is figured on Plate 1, figures 1 and 2. The sulci are two in number. Plate 1, figure 4 represents a form with five sulci and notches to correspond; it is from Wood's Bluff Alabama. There are other differences, but our knowledge of the limits of variation is not sufficient to warrant the erection of these forms into distinct species at present. *Cadulus juvenis* Meyer is common in Texas from Mosley's Ferry, Burleson Co., and in Lee County. It is tumid, with posterior end nearly circular; anterior strongly oval, and flattened on one side; the cingulum is over one third from the anterior.

Singular to relate, no specimens of *Cadulus subcoarctatus* Gabb, have been found at Wheelock or elsewhere in Texas by several collectors sent out by the writer while other species are rather common. *Cadulus compressus* M'r is evidently intended for *C. depressus* M'r from a perusal of Dr. Meyer's article.*

The Eocene species now known are, viz.:—

1. *Cadulus turritus* Lea, sp.
    Dentalium turritum Lea, Cont. to Geol., 1833.
2. *Cadulus depressus* M'r, Proc. Phila. Ac., 1884, p. 111.
    C. compressus Meyer.
3. *Cadulus subcoarctatus* Gabb.
    Ditrupa subcoarcuata Gabb, misprint.
    Ditrupa subcoarctata Gabb, Jour. Phila. Acad., vol. 4, 2nd ser., p. 386, pl. 67, fig. 47, 1860.
    Gadus subcoarctatus Gabb, Conrad's List, 1866, p. 10.
    Cadulus subcoarctatus Gabb, Dall, Trans. Wag. Free Inst. Sci., vol. 3, pt. 2, p. 444, Dec., 1892.
    Cadulus abruptus M'r & Ald., Jour. Cin. Soc. Nat. Hist., p. 40, pl. 2, fig. 2, July, 1886.
4. *Cadulus newtonensis* M'r & Ald., Jr. Cin. Soc. Nat. Hist., July, 1886.
    C. jacksonensis M'r, Amer. Jr. Sci., p. 462, 1885; Contributions, p. 65, pl. 3, fig's 8, 8a, 8b.

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*Am. Jr. Sci., vol. 30, July, 1885.

5. *Cadulus quadriturritus* M'r, Contr., p. 65, pl. 3, fig's. 7, 7a, 1886.
6. *Cadulus corpulentus* M'r, Contr., p. 66, pl. 3, fig. 5, 1886.
7. *Cadulus turgidus* M'r, Contr., p. 65, pl. 1, fig. 10, 1886.
8. *Cadulus vicksburgensis* M'r, Amer. Jr Sci., 1885, and Contr., p. 65, pl. 3, fig. 6, 1886.

PTEROPODA.

SPIRIALIS.

Spirialis elongatoidea Ald. Pl. 2, fig. 9.

Physa elongatoidea Ald., Jr. Cin, Soc. N. H., July, 1887, p. 83.

This form and the next were described as *Physæ*, but a more careful examination proves them to be Pteropods.

Spirialis choctavensis Ald.

Physa choctavensis Ald., Jr. Cin. Soc. N. H.. p. 83, 1887.

See remark upon previous species.

Creseis sp. Pl. 1, fig. 5.

This form was received from Wheelock, Texas. It is more slender than typical *Styliola simplex* M'r, but is probably that species.

GASTROPODA.

VOLVARIA.

Volvaria bulloides Lam. Pl. 2. fig. 13.

This species has heretofore been given the manuscript name of *M.* (*Volvaria*) *gabbiana* by me, and Mr. Harris has lately published it under the same specific name. A careful examination of specimens from Grignon, France proves the species to be the same.

RINGICULA.

Ringicula butleriana, nov, sp. Pl. 1, fig. 8.

Shell robust, ovate; whorls five, rounded, transversely or spirally ribbed; columella with strong callus and three folds. The outer lip thickened, smooth within; aperture large; length of the same, four-fifths of the body whorl.

Locality.—Butler, Ala.

Horizon.—Wood's Bluff beds.

Differs from *P. biplicata* Lea sp. (Pl. 1 fig. 9) by the absence of any crenulations upon the inner margin of the outer lip, and in being regularly striated. It differs from *R. mississippiensis* Con. by the regular striations, absence of a smooth band on the superior part of the whorls and in its very long aperture.

SCAPHANDER.

Scaphander primus Ald. Pl. 2, fig's. 1, 1a.

The specimen illustrated was obtained at Jackson, Miss. and is much larger and finer than the type.

Scaphander alabamensis, nov. sp. Pl. 2, fig. 2.

Shell thin, small, rather broad posteriorly ; aperture and outer lip slightly produced behind the apex ; spiral sculpture fine, lines very numerous at posterior and anterior, no pitting to lines observed ; growth lines only perceptible under a glass ; posterior apex with a pit ; margin rising to outer lip ; a very slight callus on body whorl, thicker on concave part curving over the shell.

Locality.—Gregg's Landing, Ala.

The species seems to be rare. It resembles the recent *S. watsoni* Dall, but is much broader posteriorly and the outer lip is not extended much beyond the apex.

ATYS.

Atys robustoides, nov. sp. Pl. 2, fig's 4, 4a.

Shell small, oval, subgibbous, striated, umbilicated ; lines of growth numerous, more so on the posterior half of the shell ; spirals numerous, more closely set at extremities and rather deeply cut, no pitting of the lines perceptible ; posterior end rising above apex and partly covering the posterior pit ; the callus twisting into a saddle shape to join the outer lip ; spirals closely set where they run up into the umbilicus ; pillar lip nearly straight.

Locality.—Gregg's Landing, Ala.

CYLICHNA.

Cylichna meyeri, nov. sp. Pl. 2, fig. 5.

Shell cylindrical, narrow, thin, lines of growth prominent and closely set on the posterior, becoming obsolete on the middle part of the shell ; spiral lines numerous, closely set, impressed slightly and showing very faintly through the lines of growth at the posterior end ; a deep excavation running from aperture at posterior over the apex and connecting to outer lip which projects above the opening, a strong rounded ridge marking the connection with the edge of whorl ; aperture narrow at posterior, widening at anterior, the callus thickening but without a fold, umbilicus rudimentary.

Locality,—Matthews' Landing, Ala.

Differs from *C. dekayi* Lea by its groove at posterior, the sudden thickening of lines of growth and the absence of a fold. Named in honor of Dr. Otto Meyer.

BULLINA.

Pl. 2, fig. 6.

Bullina leai, nov. sp.

Shell cylindrical, whorls five, spire depressed; suture deeply impressed; shell rounded, marked by a series of raised longitudinal lines at base that correspond to lines of growth; body whorl shouldered and bordered on upper part with a large number of very fine spiral lines which are crossed by lines of growth, the whole forming a band, shell slightly constricted just below this band; main part of body whorl nearly smooth, at the base the spiral lines again appear; columella with one fold; outer lip recurved, smooth and rounded; aperture narrow, widest at base.

Locality.—Bell's Landing, Ala.

This pretty species is distinguished by its band and constriction from the form described by Lea as found at Deal, N. J., under the name of *Acteon wetherilli*. A young specimen, probably the same species, is in my collection from the Claiborne sand bed. It shows the apex strongly papillated.

UMBRACULUM.

Pl. 1, fig's 14, a.

Umbraculum, sp.

Shell minute, surface marked with lines of growth only: apex blunt; base narrowly oval; muscular scar distinct.

Locality.—Lisbon, Ala.

This form may be the very young shell of the *U. planulatum* Conrad, but is interesting as showing the very young shell.

PLEUROTOMA.

Pl. 4, fig. 5.

Pleurotoma servatoidea, nov. sp.

Shell narrow; whorls twelve, the first four smooth, the next with transverse ribs, the balance with six to seven very prominent rounded ribs crossed by close set raised spiral lines, the lines alternating in size; whorls compressed at suture; mouth narrow, smooth within; canal long, nearly straight; anal fasciole narrow and situated at the broad part of body whorl; lines of growth not prominent.

Locality.—Gregg's Landing, Ala.

This species resembles superficially *Pleurotoma servata* Con. from the Vicksburg beds.

Pleurotoma silicata, nov. sp. Pl. 3, fig. 3.

Shell fusiform; whorls rounded, nine to ten, the first three embrionic ones smooth, the next four plicate, a few spirals on the upper part of these whorls just below the suture; spiral lines nearly obsolete on the last three whorls; whorls rounded, upper part of the body whorl constricted and all the whorls showing this feature in a diminishing degree. The body whorl has numerous fine spiral lines becoming more numerous and distinct towards the base. Aperture linear, expanding slightly below; outer lip acute, excisum large.

Locality.—Gregg's Landing, Ala.

The surface of the shell looks smooth and shining to the eye and the shell very strongly fusiform.

Pleurotoma langdoni, nov. sp. Pl. 3, fig. 5.

This species has been identified with the European *P. acuminata* Sow. by Prof. Heilprin. I give it the above name provisionally as the foreign forms seem to me to be distinct. The shell has about thirteen whorls, the first four smooth, the balance with a raised beaded band at the suture followed by the fasciolar space showing lines of growth; periphery of the whorls carrying tubercles rising obliquely from the lower half of the same and strongest at termination; spiral lines numerous, close set, somewhat beaded on the body whorl.

Locality.—Hatchetigbee Bluff; also at Wood's Bluff, Ala.

BORSONIA.

Borsonia (*Scobinella*) *conradiana*, nov, sp. Pl. 1, fig. 13.

Shell small, rather solid, spirally ribbed, ribs beaded; whorls seven to eight; aperture narrow; outer lip crenulated within; pillar lip with four strong plaits, the last one oblique to the other three.

Locality.—Wheelock, Texas.

This species has the same ornamentation as the young of *Sc. cœlata* Con. but the plaits on the pillar lip are different. Gabb's type of *S. crassiplicata* is a very young shell and seems to equal *S. cœlata* Con.

Borsonia plenta Har. & Ald. Pl. 1, fig. 12.

Mr. Gilbert D. Harris has just published this species under our joint name, so I omit any description. Very large specimens are in my cabinet 44 mm. in length and 14 mm. in width.

Borsonia sp. (young) Pl. 1, fig. 18.

Locality.—Claiborne, Ala.

Too young for identification or description.

Prof. W. M. Gabb in his article* on the Texas Eocene fossils from Wheelock and vicinity describes a new genus, *Eucheilodon*, and makes the typical species *E. reticulata*. This name it seems advisable to retain as subgeneric, and it may be placecd under *Borsonia*.

E. crenocarinata Heilprin from the Jackson beds does not differ specifically from *T. reticulata*. The type of Gabb's species of *Scobinella læviplicata* is also the same; Gabb was misled by the poor condition of his type.

Scobinella Con. might be retained as a subgenus of *Borsonia* for those forms showing more than two plaits on the columella and having a sculpture of coarse spiral lines beaded; *Cordiera* Rouault, for those forms showing two plaits on the columella and having an ornamentation like *C. biconica* Whitfield.

GLYPHOSTOMA.

Glyphostoma harrisi, nov. sp. Pl. 1, fig. 11

Shell small, whorls nine, spire acuminate, suture deeply impressed; the first four whorls smooth, the next two with longitudinal beads, balance with strongly raised spirals; suture bounded by a cord above and below, followed by a broad excavated space corresponding to the fasciolar space; lines on the last half of the body whorl with an intercalary thread; aperture narrow, outer lip slightly incurved, striate within; pillar lip thickened and bearing two (in the type) to six small plaits; umbilicus rudimentary.

Locality.—Wheelock, Texas, also in Lee and Burleson Co's.

The figure is a little too broad.

This species is placed by Mr. Harris under *P. infans* Meyer, but it seems to me to be a very different species as the latter has no plaits on the columella, is narrower, has fewer whorls and a twisted canal.

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*Descriptions of new species of American Tertiary and Cretaceous fossils.– *Jr. Ac. Nat. Sci., vol. 4, 2d ed., p. 379, 1860.*

PYRAMIMITRA.

Pyramimitra costata Lea. Pl. 2, fig. 11.

This form occurs at Jackson, Miss., Clark Co., Ala., and in Texas.

TEREBRIFUSUS.

Terebrifusus amœnus Con. Pl. 1, fig. 15.

This species seems to vary considerably and includes *T. multiplicata* H. C. Lea, *T. gracilis* Lea and *Mitra elegans* H. C. Lea.

The specimen figured is from Wood's Bluff, Ala.

FULGUR.

Fulgur eocense nov. sp. Pl. 3, fig's 7, 7a.

Shell oblong fusiform; spire obtuse; whorls seven, angulated; whorls of the spire four in number and smooth, the others covered with fine revolving striæ; periphery of the last three whorls bounded by longitudinal tubercles, sometimes a double line of these appearing upon the upper whorls; body whorl with three strong carinæ, the one on the shoulder strongly tuberculose; one varix showing in all the specimens; suture impressed, linear; outer lip internally denticulated and thickened; inner lip bearing a fold near base of aperture; canal long, nearly straight, slightly tortuous, bent upwards, finely striated to the extremity.

Localities.—Matthews' and Gregg's Landings, Ala.

LEVIFUSUS.

Levifusus trabeatus Con., var. Pl. 4, fig. 6.

This shell only differs from the type by being more spinose on the peripheral carinæ of the whorls and with the spiral lines more prominent. The species ranges through the Eocene up to and including the Jackson beds.

Levifusus branneri and *L. trabeatoides* Harris are probably varieties of this protean species. At Tuscaloosa Landing, Ala., there is a form which has a straight canal, with the outer lip thickened and strongly dentate within, also with both peripheral lines tuberculate. At Hatchetigbee Bluff, Ala., the Texas form occurs.

Locality.—Figured specimen, Matthews' Landing, Ala.

LEVIFUSUS.

Levifusus suteri, nov. sp. Pl. 3, fig. 4.

Shell oblong-ovate, whorls seven, the first three smooth, next nodular and angulated. The periphery of each whorl marked by a double spiral line or band carrying nodes, where crossed by longitudinal plications; upper part of whorls looking down on same shows a spiral line inside of the peripheral border following the sinuosities of the same; periphery of body whorl spinous and beaded, followed by a broad concave space below, then a second spiral ring, followed by a third space and ring; spiral lines cover the canal; the third spiral ring extending within the aperture; outer lip smooth, aperture quadrate above with a narrowing canal below; columella smooth, curved; canal slightly twisted, umbilicus rudimentary.

Locality.—Matthews' Landing, Ala.

Resembles *L. trabeatus* Con.vars, but has a fusoid canal. Named in honor of my young friend, Henry Suter, Esq., of New Zealand.

LATIRUS.

Latirus alabamensis, nov. sp. Pl. 1, fig. 17.

Shell small, solid; whorls six, apex smooth; whorls spirally striated, suture strongly impressed; labrum striate, denticulate within, striations extending within the aperture, three nodular elevations at narrow part of pillar lip; canal recurved, short.

Locality.—Hatchetigbee Bluff, Ala.

This species is doubtfully placed in *Latirus*. It has no umbilicus.

FUSUS.

Fusus? whitfieldi, nov. sp. Pl. 4, fig. 4.

Shell thin, broadly fusiform, whorls ten, first four smooth, the next partly smooth and partly transversely ribbed, the balance angulated with ribs on the lower half of whorl; surface reticulated; the spiral lines alternate in size, very closely set, the smaller spiral line beaded on the body whorl; constricted at suture; outer lip sigmoid, smooth within; canal slightly bent.

Locality.—Matthews' Landing and Gregg's Landing, Ala.

This shell partakes so much of a Pleurotomid, I hesitate to put it under *Fusus*.

FUSUS.

Fusus harrisi, nov. sp. Pl. 4. fig's 2 & 8.

Shell stout, broadly fusoid, whorls eight to nine, the first three smooth, the apical one slightly immersed, generally missing, balance transversely ribbed; ribs rounded, about eight on each whorl; spiral lines very close-set and stronger at centre of whorls; outer lip strongly sigmoid as also the lines of growth; the shell has a cancellated appearance under a glass; columella twisted, canal turned upwards at base.

Locality.—Gregg's Landing, Ala.

Fusus? mohri, nov. sp. Pl. 3, fig. 6.

Shell broadly ovate, apex pointed; whorls ten, the first five very small, smooth, the sixth partially so passing into the adult stage; adult whorls with six strongly developed transverse ribs which are angular at the periphery; spiral sculpture coarse, more so at the junction with the ribs, making each one to terminate in a rounded and beaded projection broader at the point than elsewhere; columella straight, slightly thickened at the lower half of the aperture; canal straight.

Locality.—Matthews' Landing, Ala.

Named in honor of Dr. Chas. Mohr, of Mobile, Ala.

Fusus siphus, nov. sp. Pl. 3, fig. 2.

Shell fusoid, whorls eight, the first three smooth, the others strongly striated, costate; the lines of growth prominent, crossed by fine spirals; suture impressed, banded by a raised ridge, which is followed by a compressed space; whorls shouldered by the ridge, body whorl longer than balance of shell, shouldered, the longitudinal lines bent at shoulder so that they are sigmoid and give the shell somewhat the appearance of a *Pleurotoma*; aperture rather narrow, callus thin, the lines ending abruptly in most cases at the same; outer lip smooth, canal slightly twisted.

Locality.—Gregg's Landing, Ala.

STREPSIDURA.

Strepsidura heilprini, nov. sp. Pl. 4, fig. 1.

Shell short, stout; whorls nine, first four smooth, embryonic, the fifth costate, the others with about six profoundly raised and rounded transverse ribs; surface reticulated, apex pointed; outer lip striated within; columella twisted, bearing at the narrow part far within a single fold; canal extremely twisted and turned upward at base.

Locality.—Matthews' Landing, Ala.

This beautiful species has a general resemblance to *Fusus subscalarinus* Heilpr. The figure does not show the reticulated surface well nor the extreme torsion of the canal. The drawing was made from a half-grown specimen ; named in honor of Prof. A. Heilprin, of Philadelphia, Pa.

Strepsidura ficus Gabb sp. Pl. 3, fig. 1, 1a.

Whitneya ficus Gabb. Geol. Cal., Paleont., vol. 1, p. 104, pl. 28, fig. 212, 1864.

It is due to Mr. G. D. Harris that the above species is identified with the California form. The writer had renamed it and this name is now fortunately suppressed.

SIPHO.

Sipho erecta, nov. sp. Pl. 4, fig. 7.

Shell small, whorls nine, the first four smooth ; apex pointed ; shell cingulate ; lines of growth showing between the revolving ribs ; suture impressed ; whorls slightly shouldered ; aperture narrow ; outer lip thin, smooth within ; columella thickened ; canal somewhat recurved.

Locality.—Wood's Bluff, Ala.

PISANIA.

Pisania (*Tritonidea*) *johnsoni*, nov. sp. Pl. 4, fig. 9.

Shell small, solid, two or three embryonic whorls, five subsequent ; three to four broad spiral ribs on the whorls above and about thirteen on the body whorl, also fine spirals between ; canal short, recurved ; outer lip dentate internally, with a single heavy callosity or rib opposite the anterior part of the aperture ; inner lip granulose above ; suture impressed.

Locality.—Bell's Landing, Ala.

COLUMBELLA.

Columbella mississippiensis M'r & Ald. Pl. 1, fig. 19, 19a.

This form differs from the typical only by the plaits on the columella being nearly obsolete.

Locality.—Wood's Bluff. Ala.

MUREX.

Murex elegantissimus, nov. sp. Pl. 4, fig. 3.

Shell rather solid ; whorls eight, first three embryonic with about ten nodose, rounded ribs slightly pointed at periphery of some examples, others rounded, covered with close-set spiral lines except above the shoulder where there is a smooth space to suture; outer lip thick, with a few denticulations within; canal open and twisted; no umbilicus.

Locality.—Gregg's Landing, Ala.

This figure was made from a young shell. Much larger specimens are now before me. It is possible this may be the unfigured *M. septemnarius* Con., but it differs from the description.

Murex (*Pteronotus*) *grandispinosa*.

" " *burnsi* Ald., The Nautilus, vol. 7, No. 9, p. 98, pl. 4, fig's 4, 4a, 1894.

Prof. W. H. Dall* has changed *M. shilohensis* Heilp. var. *burnsi* Whitf. into a distinct species and this necessitates a change of name in ours.

PYRULA.

Pyrula (*Fusoficula*) *texana* Har., Proc. Ac. Nat. Sci. Phila., 1885, p. 77, pl. 8, fig. 11.

Odontopolys texana Ald., MS.

Volutilithes? rectus Ald., MS. Pl. 2, fig's 12, 12a.

This species is a peculiar form rather difficult to place generically and I am not yet satisfied with the position assigned by Mr. Harris. Occurs at Newton, Miss., Lisbon, Ala., and Texas.

GONIOBASIS.

Goniobasis texana Heilprin. Pl. 2, fig. 3.

This form was described by Prof. Heilprin as a *Cerithium* but more perfect specimens than he had prove it to be a gigantic *Goniobasis*. Two specimens are in my collection from Texas; the largest if perfect would be over four inches in length. There is but little difference between this form and *G. trigemmata* Conrad sp., Alabama, and I have no doubt they will be eventually united.

The figure was drawn from a very young shell.

Locality.—Wheelock and Lee Co., Tex.

RISSOINA.

Rissoina alabamensis, nov. sp. Pl. 2 fig. 8.

Shell solid; whorls nine, the first four smooth, embryonic, then follow four rounded adult whorls showing fine spiral lines which are slightly pitted at the intersections of lines of growth with them ; body whorl rounded, convex, contracted below centre to form the base on which the lines of growth are more strongly marked ; aperture oblong-ovate outer lip channelled anteriorly, thickened and expanded posteriorly and strongly sigmoid.

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*Trans. Wag. Fr. Inst., vol. 3, p. 141, 1890.

Locality.—Matthews' Landing, Ala.

The figured type shows a strong varix on the body whorl which is not generally present. Whorls vary from seven to nine. Rather common.

TUBA.

Tuba (*Mathilda*) *claibornensis* Ald. Pl. 1, fig. 7.

J. Cin. Soc. N. H., July, 1887.

A figure is here given of this species. It is quite a rare shell. It seems as if *Mathilda* should be retained as a subgenus of *Tuba*. A careful examination of Lea's species of *Tuba*, show that *T. sulcata* is a broken specimen of *Ranella maduri* Con. *plus Pisania claibornensis* Whitf. *plus Triton pyramidatum* H. C. Lea and is a *Triton*.

CERITHIODERMA.

Cerithioderma (*Mesostoma*) *prima* Con. Pl. 1, fig. 10.

Mesostoma lisbonensis Aldr. (MS.)

Differs from the typical form in being much coarser, with smaller aperture, more robust and short. I am satisfied that Dall is correct (Tr. Wagner Inst. p. 293, 1892) in uniting this form to Conrad's shell and that *C. rugosa* Heilprin is a synonym.

Locality.—Lisbon, Ala.

MELANOPSIS.

Melanopsis planoidea, nov. sp. Pl. 2, fig. 7.

Shell ovoid, spire high ; whorls smooth; over five in number; body whorl large; suture distinct, apex eroded; aperture ovate, angular at posterior, outer lip thin, extending below the terminus of the columella ; inner lip bent and slightly twisted at the extremity; callus thin, moderate, thickened posteriorly.

Locality.—Gregg's Landing, Ala.

This species resembles *M. anita* Aldr. described from the same locality, but differs in shape; the body whorl is not so large or so long and the spire more regular ; apex is missing ; outside of the slightly excised canaliculate aperture it more nearly resembles the genus *Goniobasis*.

SIGARETUS.

Sigaretus (*Sigaticus*) *clarkeanus* Aldr. Pl. 1, fig. 16.

Hitherto unfigured; it is described in Jour. Cin. Soc. Nat. Hist. p. 83, July, 1887.

Locality.—Choctaw Corner, Ala.

Horizon.—Woods' Bluff section.

PELECYPODA.

OSTREA.

Ostrea cretacea Morton. Pl. 5, fig 10.

Locality.—Hatchetigbee Bluff and "the Rocks," Clark Co., Ala., in white limestone.

PECTEN.

Pecten choctavensis, nov. sp. Pl. 5, fig. 7.

Shell suborbicular thin, depressed, finely, closely ribbed, ribs showing through the substance of the shell, imbricated near vertral margin and on the anterior slope, smaller ribs showing between on the anterior slope; ears ribbed and ribs imbricated with fine, oblique reticulations between.

Locality.—Choctaw Corner and Wood's Bluff, Ala.

Pecten clarkeanus, nov. sp. Pl. 5, fig. 11.

Shell orbicular compressed; ears nearly equal; beaks pointed; both valves about equal, the right one convex the umbones more slightly convex, the apex of valves smoother very minutely striated the lower and older part strongly marked with about 48 radiating ribs, strongest on the right valve, anterior ear on right valve with a sinus, ears striated.

Locality.—Sowilpa Cr., Ala.

Geological horizon. Lisbon beds.

This species combines the characters of two subgenera. The ribs in some specimens are quite plain near the beaks, then become obsolete and suddenly reappear below, where they often bifurcate. Examined under a glass, the ribs appear to be smooth and rounded; on the left valve the beaks are ribbed, but on the right they appear to be smooth. Young specimens are difficult to distinguish from *P. scintillatus* Conrad.

MODIOLA.

Modiola alabamensis, nov. sp. Pl. 5, fig. 13.

Shell strongly arcuate, surface with raised lines closely set becoming nearly obsolete on the beaks; a few lines of growth crossing the striæ; beak small, hinge margin slightly curved, ascending; very small fissure on basal margin.

Locality.—Choctaw Corner, Ala.

Geological horizon.—Wood's Bluff section.

LITHODOMUS.

Lithodomus claibornensis Con. Pl. 5, fig. 14.

Locality.—Claiborne, Ala.

LEDA.

Leda robusta, nov. sp. Pl. 5, fig. 1, 1a.

Shell robust, inequilateral; surface covered with rather coarse folds most prominent on the umbo ; anterior elliptically rounded with an obtuse carination ; posterior pointed, abruptly narrowing; upper posterior margin strongly carinated with a deep furrow running from beak to margin ; the folds continue across both furrow and escutcheon ; teeth arched, most prominent on posterior; cavity of the shell deep ; interior polished ; fosset set well under the beaks which incline towards the posterior.

Locality.—Lower bed, Wood's Bluff, Ala.

Distinguished from all others by its rotund shape, giving it almost the appearance of a *Corbula* ; rather common.

Leda elongatoidea, nov. sp. Pl. 5, fig. 2.

Shell inequilateral; flattened; surface with fine concentric folds, rugose on the upper posterior margin, which is bordered by two carinated lines; anterior elliptically rounded, folds more distinct at the margin near the beaks; teeth inequilateral, closely set, numerous, their apices pointing towards beak; posterior carination showing through the shell; fosset deep; margin entire.

Locality.—Butler, Ala.

Geological horizon.—Wood's Bluff section.

Approaches closely to *L. protexta* Con., but it is much more inequilateral. Larger specimens are grooved on the posterior margin and have the aspect of a *Yoldia*. The drawing is made from a half grown specimen, and is not very characteristic.

Leda lisbonensis, nov. sp. Pl. 5, fig. 4

Shell oblong, lanceolate ; very inequilateral, the posterior part being nearly twice as long as the anterior ; compressed ; beak very small, smooth ; escutcheon striated, depressed, bordered outwardly by a serrated rib ; posterior slope with two ribs, forming a flattening space ; the postertor surface of the shell covered with rounded, close-set, transverse folds, which terminate centrally ; anterior half smooth, with a depressed space running obliquely from the beak to the ventral margin ; lines of growth faint, perceptible upon anterior ; anterior margin rounded, convex, while the posterior is raised ; teeth numerous, very closely set and pointed ; fosset small, with rounded cavity.

Locality.—Lisbon, Ala.

Geological horizon.—Lower Claiborne.

This remarkable species grows nearly three inches long, and is very distinct from any other tertiary form except *Leda magna* Lea, sp. It differs from that species, of which fragments are in my cabinet, by a remarkable lanceolate shape, and length of posterior.

Leda semenoides, nov. sp. Pl. 5, fig. 5.

Shell small, thin, deeply folded ; margin entire. Shell very similar to *L. semen* Lea, sp., but does not have the rostrum of that species ; the teeth are smaller also.

Locality.—Lisbon, Ala.

YOLDIA.

Yoldia corpulentoides, nov. sp. Pl. 5, fig. 9, 9a.

Shell oblong, nearly equilateral, swollen centrally, anterior rounded, not gaping ; posterior attenuated closed on the ventral part, suddenly gaping and leaving an oral opening between the valves near the extremity; beaks compressed a ridge running from them to posterior ; shell finely, concentrically striated ; teeth numerous, equal on each side ; fosset set well under, small but deep, pallial sinus moderate; a strong intestinal impression in the anterior part, anterior muscular scar well defined.

Locality.—Tuscahoma Landing, Ala.

Geological horizon.—Bell's Landing section.

Found in place incased in blue clay.

TELLINA.

Tellina subtriangularis, nov. sp. Pl. 5, fig. 8, 8a.

Shell subtriangular, rather compressed, surface with close-set regular concentric lines; anterior side longest, elliptically rounded, posterior subtriangular ; beak smooth, cardinal teeth two ; subtriangular posterior one almost bifid, laterals strong ; pallial line plainly marked, anterior muscular impression the strongest.

Locality.—Hatchetigbee Bluff, Ala.

Only the right valve known, resembles the recent *Tellina punicea* Born in outline.

PERIPLOMA.

Periploma butleriana, nov. sp. Pl. 5, fig. 3.

Shell thin, fragile, ovate, inequilateral, very slightly gaping, with a large tooth curved toward the posterior, an internal rib running from base of tooth to posterior margin, a groove on the anterior side of the tooth, and a slight internal folding on the anterior of the shell.

Localities.—Butler, Ala.; Baker's Bluff, Ala.

Geological horizon.—Wood's Bluff section.

Only two specimens found. The tooth is not strongly spoon shaped, but rounded, and curves both upwards and to one side.

CORBULA.

Corbula concha, nov. sp. Pl. 5, fig. 6.

Shell oblong, ovate, inequilateral; surface striate; posterior somewhat produced and rounded, and the larger; anterior elliptically rounded; tooth large and oblong; cicatrices very slightly impressed; cavity of shell rather deep.

Locality.—Bell's Landing, Ala.

Geological horizon.—Bell's Landing section of the Lignitic.

A large species of this genus. It differs from any other by its smooth surface, large posterior end, and faint muscular impressions.

GASTROCHÆNA.

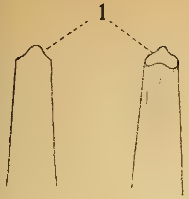
Gastrochæna larva, Con. Pl. 5, fig. 12.

Locality.—Claiborne sand bed, Claiborne, Ala.

EXPLANATION OF PLATE I

(2)

Fig. 1.	*Cadulus subcoarctatus* Gabb, var.,	Page 4, 56.
2.	” ” ”	4, 56.
3.	*Dentalium multannulatum*,	3, 55.
4.	*Cadulus subcoarctatus* Gabb, var.,	4, 56.
5.	*Creseis* sp.,	5, 57.
6.	*Dentalium microstria* Heilprin,	3, 55.
7.	*Tuba* (*Mathilda*) *claibornensis* Aldr.,	15, 67.
8.	*Ringicula butleriana*,	5, 57.
9.	” *biplicata* Lea sp.,	5, 57.
10.	*Cerithioderma* (*Mesostoma*) *lisbonensis*,	15, 67.
11.	*Glyphostoma harrisi*,	9, 61.
12.	*Borsonia plenta* H. & A.,	8, 60.
13.	*Borsonia* (*Scobinella*) *conradiana*,	8, 60.
14.	*Umbraculum* sp. ?	7, 59.
14 a.	”	”
15.	*Terebrifusus amœnus* Con.,	10, 62.
16.	*Sigaretus* (*Sigaticus*) *clarkeanus* Aldr.,	16, 68.
17.	*Latirus alabamensis*,	11, 63.
18.	*Borsonia* sp. ? young,	9, 61.
19, 19 a.	*Columbella mississippiensis* M. & A.,	13, 65.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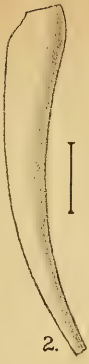
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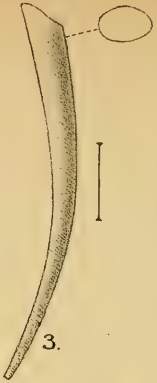
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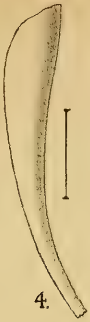
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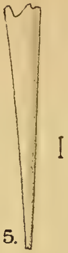
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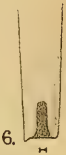
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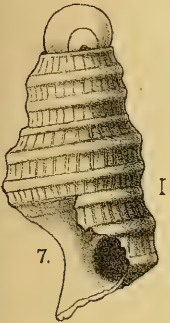
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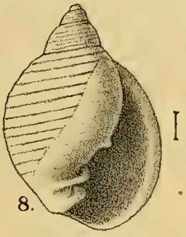
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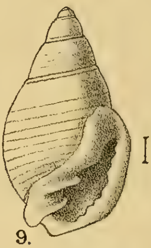
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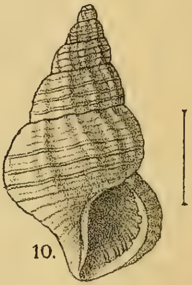
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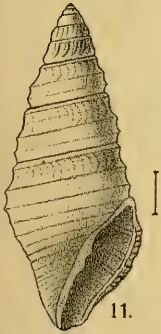
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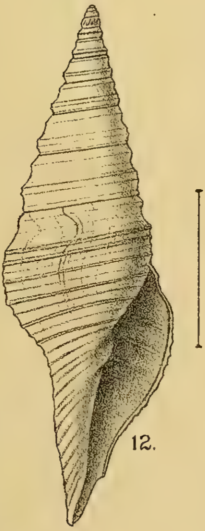
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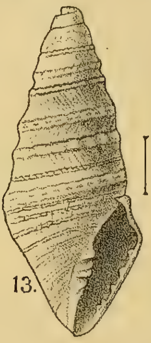
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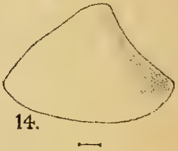
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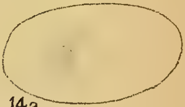
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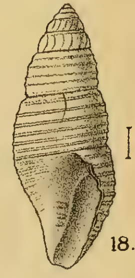
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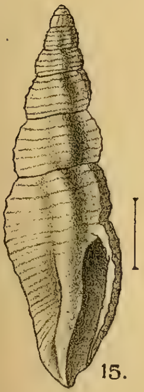
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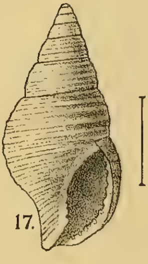
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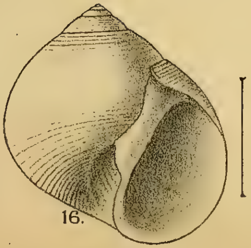
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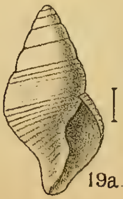
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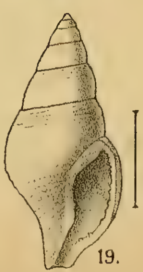
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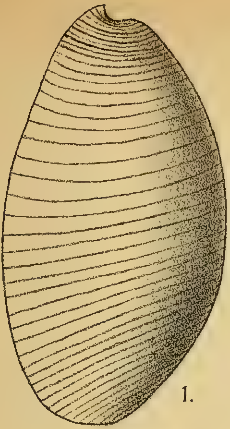
EXPLANATION OF PLATE 2

(3)

Fig.	1.	*Scaphander primus* Ald.,	Page 6, **58**.
	1a.	” ”	”
	2.	*Scaphander alabamensis*,	6, **58**.
	3.	*Goniobasis texana* Heilp.	17, **69**.
	4.	*Atys robustoides*,	6, **58**.
	4a.	” ”	”
	5.	*Cylichna meyeri*,	6, **58**.
	6.	*Bullina leai*,	7, **59**.
	7.	*Melanopsis planoidea*,	15, **67**.
	8.	*Rissoina alabamensis*,	14, **66**.
	9.	*Spirialis elongatoidea*,	5, **57**.
	10.	*Spirialis choctavensis*,	5, **57**.
	11.	*Pyramimitra costata*,	10, **62**.
	12.	*Pyrula* (*Fusoficula*) *texana* Harris,	14, **66**.
	12a.	” ” ” ”	”
	13.	*Volvaria bulloides* Lam.,	5, **57**.

Plate 2.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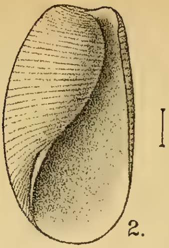
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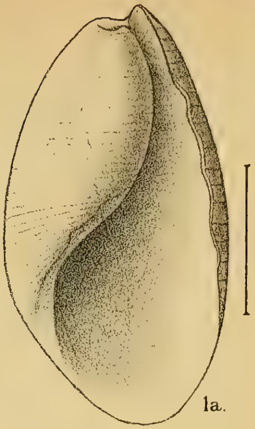
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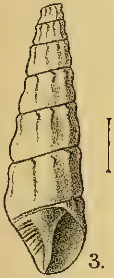
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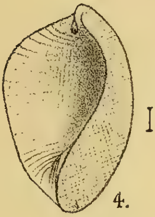
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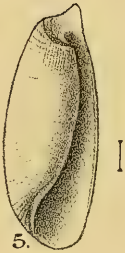
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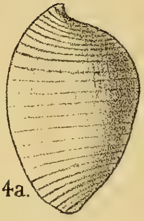
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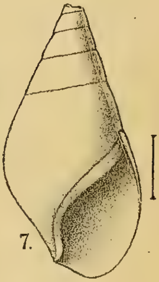
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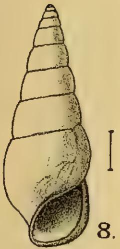
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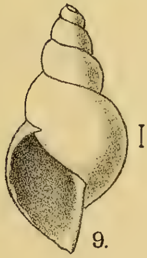
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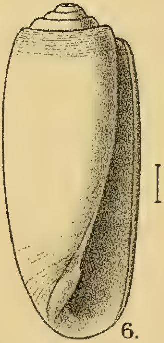
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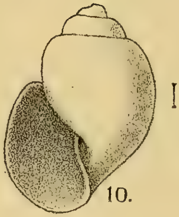
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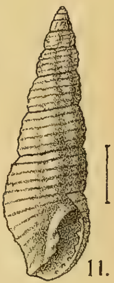
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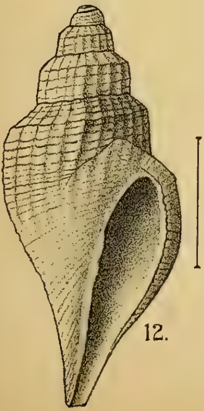
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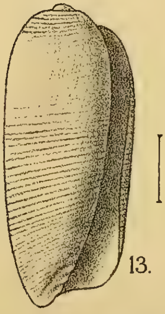
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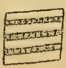

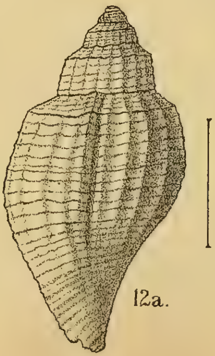
12a.

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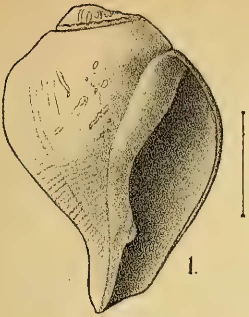
EXPLANATION OF PLATE 3.

(**4**)

Fig. 1, 1 a.	*Strepsidura ficus* Gabb sp.,	Page 13, **65**.
2.	*Fusus siphus*,	12, **64**.
3.	*Pleurotoma silicata*,	8, **60**.
4.	*Levifusus suteri*,	11, **63**.
5.	*Pleurotoma langdoni*,	8, **60**.
6.	*Fusus mohri*,	12, **64**.
7, 7 a.	*Fulgur eocense*,	10, **62**.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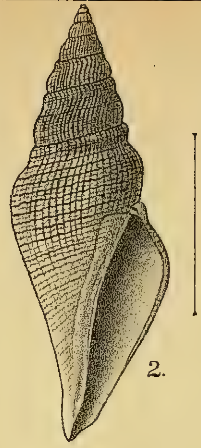
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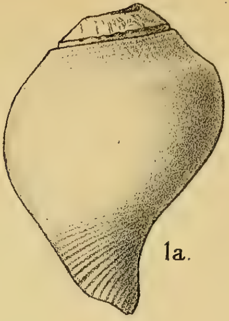
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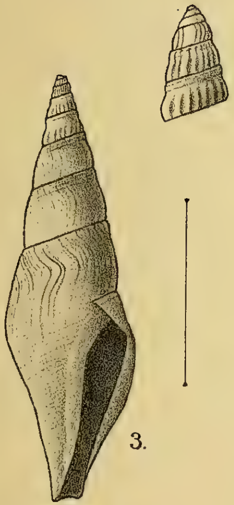
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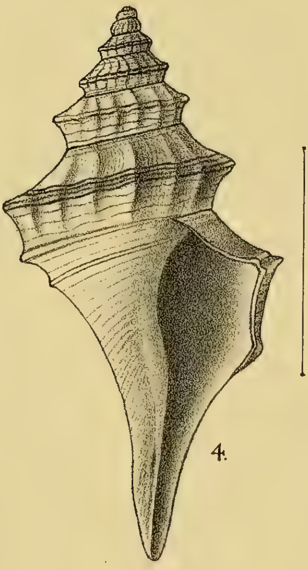
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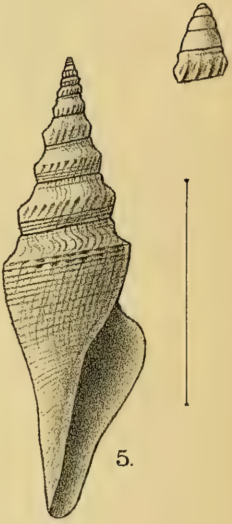
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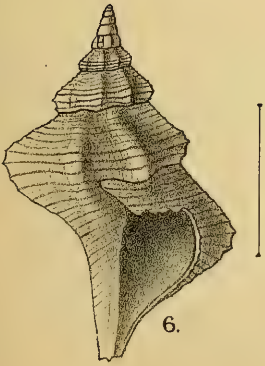
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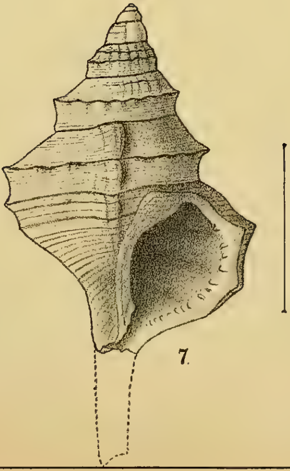
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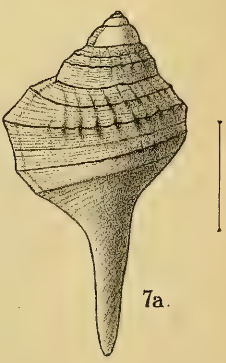
7a.

O. MEYER, DEL.

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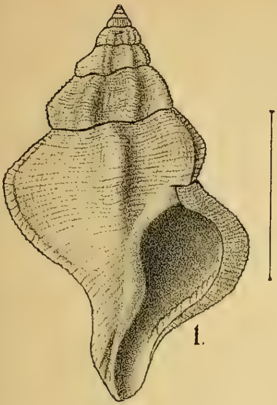
EXPLANATION OF PLATE 4

(5)

Fig. 1.	*Strepsidura heilprini,*	12, 64.
2.	*Fusus harrisi,*	12, 64.
3.	*Murex elegantissimus,*	13, 65.
4.	*Fusus whitfieldi,*	11, 63.
5.	*Pleurotoma servatoidea,*	7, 59.
6.	*Levifusus trabeatus* Con., var.,	10, 62.
7.	*Sipho erecta,*	13, 65.
8.	*Fusus harrisi,*	12, 64.
9.	*Pisania (Tritonidea) johnsoni,*	13, 65.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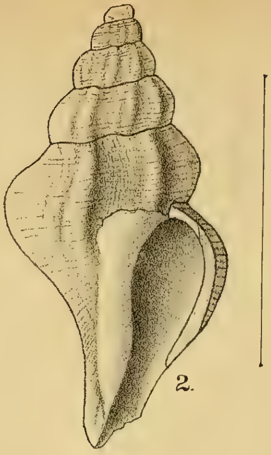
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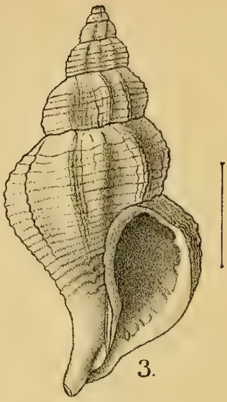
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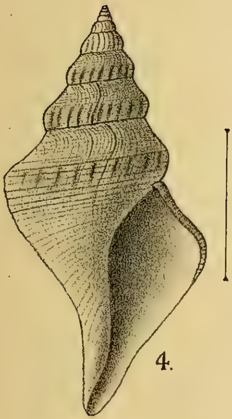
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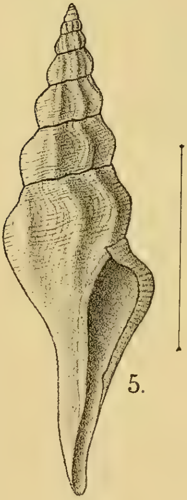
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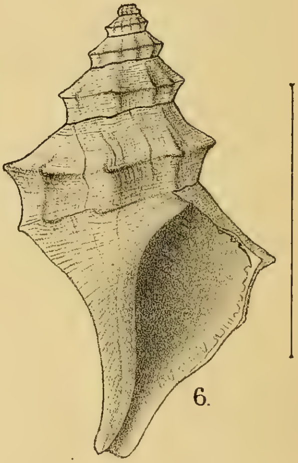
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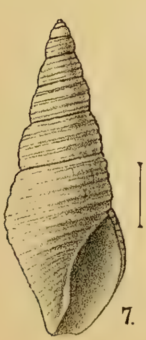
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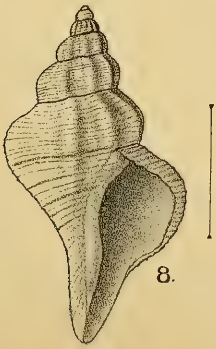
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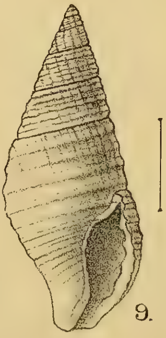
9.

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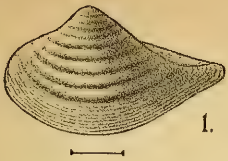
THE KREBS LITHOGRAPHING CO. CIN. O.

EXPLANATION OF PLATE 5

(**6**)

Fig. 1, 1a.	*Leda robusta*,	17, **69**.
2.	*Leda elongatoides*,	17, **69**.
3.	*Periploma butleriana*,	19, **71**.
4.	*Leda lisbonensis*,	17, **69**.
5.	*Leda semenoides*,	18, **70**.
6.	*Corbula concha*,	19, **71**.
7.	*Pecten choctavensis*,	16, **68**.
8, 8 a.	*Tellina? subtriangularis*,	18, **70**.
9, 9 a.	*Yoldia corpulentoides*,	18, **70**.
10.	*Ostrea cretacea* Morton,	16, **68**.
11.	*Pecten clarkeanus*,	16, **68**.
12.	*Gastrochæna larva* Con.,	19, **71**.
13.	*Modiola alabamensis*,	16, **68**.
14.	*Lithodomus claibornensis* Con.,	17, **69**.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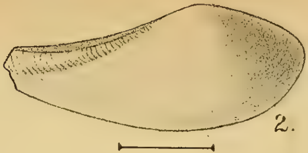
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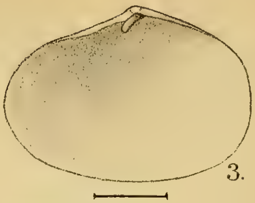
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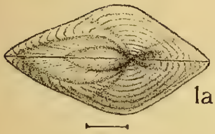
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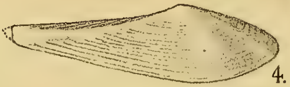
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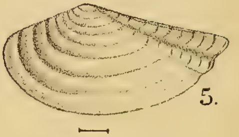
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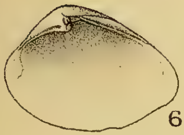
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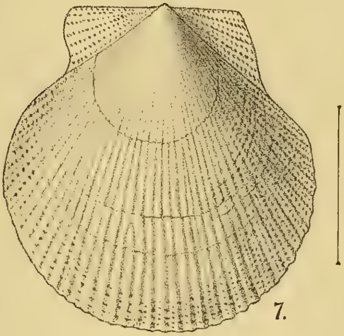
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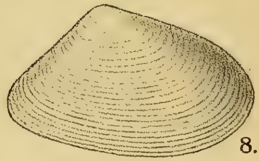
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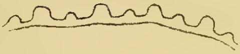

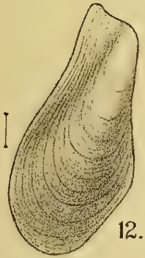
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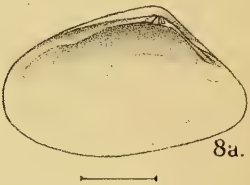
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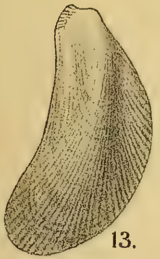
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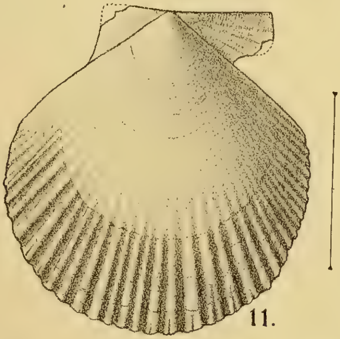
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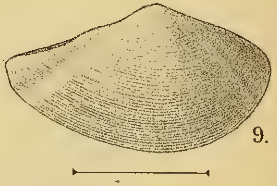
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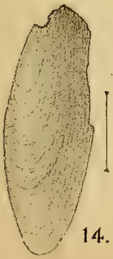
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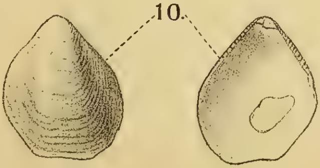
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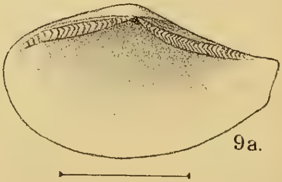
9a.

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ERRATA.

BULLETIN No. 1.

Page 30, between *Abra nitens* and *Planaria nitens* put **nitens** Lea.

BULLETIN No. 2.

Page 8, line 5; for embrionic, read embryonic.

Vol. I

BULLETINS
OF
AMERICAN PALEONTOLOGY

No. 3

NEOCENE MOLLUSCA OF TEXAS,
OR
FOSSILS FROM THE DEEP WELL AT GALVESTON

BY

G. D. HARRIS

December 2, 1895

Cornell Univ., Ithaca, N. Y.
Harris Company

NEOCENE MOLLUSCA OF TEXAS,

Or,

Fossils from the Deep Well at Galveston.*

By

Gilbert D. Harris.

In a recent article by the present writer, published in the Philadelphia Academy's Proceedings, reference is made to a monograph on the Tertiary Mollusca of Texas, which, owing to the lack of funds at the disposal of the State Geological Survey, had remained for some time unpublished.

That the reader may have a clear idea as to what part of that monograph the Academy published and what part we purpose to bring out in this Bulletin, a summary of its contents is here given just as it was when completed, December 23, 1893.

Monograph of the Marine Tertiary Mollusca of Texas.

By Gilbert Dennison Harris.

Preliminary Remarks, pp. 1 - 5.†

Part 1. *Brief review of the literature on the Tertiary mollusca of Texas*, pp. 6 - 21.

Part 2. *Eocene mollusca of Texas*, pp. 22 - 352. — The name, author, synonymy, original description, additional remarks, all known localities for each species in Texas, important localities in other States, geological range, and where the type specimen may now be found.

Addenda to Part 2. *New or interesting Eocene mollusca from other States*, pp. 353 - 357,

Part 3. *Neocene mollusca of Texas, or Fossils from the Galveston deep well*, pp. 358 - 397. — The name, etc. as in Pt. 2, and the range in depth of each species.

Part 4. *Definition and correlation of the marine Tertiary deposits of Texas*, pp. 398 - 409. — Section 1. Review of the works and opinions of earlier writers. Sec. 2.

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*Published by permission of the State Geologist, E. T. Dumble.

†Type-written pages, each equivalent to ¾ an 8vo printed page.

Conclusions drawn from the present paleontological study.

The last mentioned part is followed by (1) a detail account of all the localities or stations whence the Tertiary fossils were obtained, (2) a table showing at a glance the geographical distribution of the Eocene molluscan species in Texas and their geological range in this State and others farther east, (3) a table showing the bathymetric distribution of the Galveston well fossils, pp. 410-434, and (4) 36 large octavo plates illustrating the species mentioned or described in Parts 2 and 3.

The article published by the Academy contained the description of the new species of Part 2 and the figures belonging thereto; the majority of that part, and which alone is of present stratigraphic value, still remains in manuscript.

This Bulletin is practically a condensation of Part 3. It seems advisable that this unique material should no longer remain unpublished, for up to this date no other marine Neocene fossils are known from the Gulf slope west of Mississippi. The opinions expressed, regarding the age of the deposits penetrated, in the American Journal of Science, vol. 46, p. 42, and in the 4th Annual Report of the State Survey, 1893, are still maintained; in brief the section is as follows:—

Depth in feet.	*Geological horizon.*
46 to 458	Pleistocene.
548 to 1,510	Doubtful.
1,510 to 2,158	Upper Tertiary.
2,158 to 2,920	Miocene (Upper).

Specific Characterization.

PELECYPODA.

PECTEN.

Pecten sp.

Syn. *Pecten*, sp., 4th Ann. Rep. Tex. Surv., 1893, p. 121.

Characterization. – Subcircular in outline; right valve generally inflated about the umbonal region, with 16 or 17 smooth flat ribs equal in width to the interspaces; interspaces with more or less prominent concentric sculpturing; ears, especially the anterior with radiating costæ more or less fimbriately sculptured; space between the ears and the extreme lateral costæ on the side of the valve, smooth and moderately broad: left valve much less inflated; with 17 or 18 slightly narrower and less flattened ribs with broader interspaces strongly marked by concentric striæ; ears nearly equal, radially striate; space between them and the extreme lateral ribs, smooth.

This species somewhat resembles *P. inæqualis* Sow., from West Indian Miocene deposits. That species, however, is smaller and more oblique. *P. dislocatus* Say is much less inequivalve and has two or three more costæ on each valve; the spaces too, between the extreme anterior and posterior ribs and the ears are radiately striate or costate.

Range in depth. – From 2,236 to 2,920 feet.

MYTILUS.

Mytilus incrassatus.

Syn. *M. incrassatus* Con., Am. Jr. Sci., vol. 41, 1841, p. 347.
" " Con., Foss. Med. Tert., 1845, p. 74, pl. 32, fig. 4.
Mytiloconcha incrassata Con., Pr. Ac. Nat. Sci. Phila., 1862, p. 291.

I am not aware that *Mytili* of this general type have appeared on the Atlantic or Gulf slope since late Miocene or early Pliocene times. Forms still living in the Pacific have ponderous shells with thickened hinge area, as for example *M. magellanicus*, but none agree quite so well with the Galveston species as *incrassatus* does.

Range in depth. – From 2,384 to 2,871 feet.

DREISSENSIA.

Dreissensia sp.

This form is very abundant, but generally badly eroded; differs but little from specimens now living on the coast of Florida.

Range in depth. – From 2,123 to 2,873 feet.

ARCA.

Arca incongrua.

Syn. *A. incongrua* Say, Jr. Ac. Nat. Sci. Phila., vol. 2, 1822,

p. 268.
A. incongrua Reeve, Conch. Icon., vol. 2, pl. 8, fig. 50.

The Galveston specimens are small, but are well preserved and seem to admit of no doubt as to their identity with Say's species.

Range in depth. – From 2,443 to 2,920 feet.

Arca ponderosa var. *carolinensis.*

Syn. -- *Nœtia ponderosa* var. *carolinensis* Con., Proc. Phila. Ac. Nat. Sci., 1862, p. 290.
N. carolinensis Con., *ibid.*, p. 580.

The only differences observable between this variety as represented by specimens from the Natural Well, Duplin Co., N. C., and typical *ponderosa* seem to be that *carolinensis* is more nearly rectangular in outline and is more inequilateral. Conrad says, — "Compared to typical *ponderosa* it is less ventricose, proportionally longer, has 35 ribs whilst the latter has 26." I fail to find such a decided difference in the number of ribs in the two forms. They are very closely related. *Carolinensis* moreover has some features in common with *limula.*

Range in depth. – From 2,552 to 2,871 feet.

Arca transversa var. *busana*, n. var.

Syn. *Arca* young of *floridana?* Harris, 4th Ann. Rep. Geol. Surv. Tex., 1893, p. 121.

In my preliminary report on the organic remains from this well I queried the identity of this form with *floridana* though it agrees well with young specimens so labelled in the collection of the U. S. National Museum. It now seems quite certain that some of the Museum specimens are improperly labelled and that they should be regarded as specifically distinct from *floridana.* Following the advice of my friend, Mr. C. T. Simpson, I here refer the Galveston well specimens to a varietal form of *transversa*, for which the name *busana* is proposed. This variety may be defined as follows :—

General characteristics as in *transversa*, but much more elongated and less inflated ; hinge line not so extended as in *lienosa* or *floridana*, posterior broader, and base more nearly rectilinear, or even emarginate.

All the specimens from the well are young, the largest being but 12 mm. in length.

Range in depth .-- From the surface to 2,920 feet.

Arca labiata Sowerby, var. Pl. 1, fig's 1, 1a.

Syn. *A. labiata* Har., 4th Ann. Rep. Geol. Surv. Tex., 1893, p. 121.

Arca (small *Limopsis*-like) Har., *ibid.*; very young.

The specimens derived from the well at Galveston are generally small, though fragments of adults occur. The only difference between these Miocene specimens and those now living on the west coast of Mexico and Central America is that in the latter the ligamental area in either valve is broader and more nearly isosceles-triangular in outline. Accordingly the beaks in the well specimens are less distant and are twisted anteriorly. The correspondence of this variety with an undescribed form from the Pliocene of Alligator creek, Florida, is close. The well specimens are doubtless ancestral to both later forms and hence partake somewhat of the nature of both.

Range in depth. — From 2,510 to 2,871 feet.

LEDA.

Leda concentrica ? Say.

Syn. *L. concentrica* Har., 4th Ann. Rep. Geol. Surv., p. 121.

There is no question as to the identity of the two varietal forms included under this name with specimens collected from the Gulf shore and now included in the collection of the U. S. National Museum. There is some doubt in the mind of the writer as to whether all may properly be called *concentrica* Say.

Range in depth.— From the surface to 2,650 feet.

CRASSATELLA.

Crassatella gibbesi T. and H., var.

Syn. *C. gibbesi*, var., Har., 4th Ann. Rep. Tex. Surv., p. 121.

Dall's *C. floridana* is evidently a variety of this species. It differs from *gibbesi* in that (*a*) its posterior is less acute, (*b*) its anterio-dorsal margin is slightly concave while in *gibbesi* it is convex. For an excellent figure of *floridana* see Bull. U. S. National Museum No. 37, pl. 42, fig. 4.

The variety from the Galveston well is still further removed from *floridana*, its posterior being quite pointed. From *gibbesi* it seems to differ in having the two anterior cardinal teeth in the left valve less similar in size; the more medially located tooth is very small, and the lower border of the hinge plate curves slightly upwards at the point where the tooth approaches it. In typical *gibbesi* these two teeth are nearly equal and the lower border of the hinge plate is either straight or decurving where these teeth impinge upon it. That these varieties are not of specific importance becomes evident upon comparing specimens of Miocene, Pliocene, and recent age.

Range in depth. — From 2,158 to 2,920 feet.

ERIPYHLA.

Eriphyla galvestonensis, n. sp. Pl. 1, fig's 2, a, b.

Syn. *Eriphyla* sp. Har., 4th Ann. Rep. Geol. Surv., p. 121.

Specific characterization.— Form as indicated by the figures; hinge as in *E. lunulata*; exterior smooth, slightly undulating concentrically near the beaks; beaks, as in many species of *Astarte* and *Crassatella*, slightly flattened at the very apex but very gibbous just below.

Eriphyla lunulata is an exceedingly variable shell and is abundant in recent, Pliocene, and Miocene deposits on the Atlantic slope of the United States, but none in all the collection of the U. S. National Museum seem to correspond entirely in shape and much less in surface markings with this form.

Range in depth.— From 300 to 2,600 feet.

LUCINA.

Lucina crenulata.

Syn. *L. crenulata* Con., Foss. Sh. Med. Tert., 1840, p. 39, pl. 20, fig. 2.
L. crenulata Harris, 4th Ann. Rep. Geol. Surv., p. 121.

Range in depth.— From 2,410 to 2,871 feet.

Lucina dentata.

Syn. *L. dentata* Wood, Gen. Conch., p. 195, pl. 46, fig. 7, 1817.
L. dentata Harris, 4th Ann. &c., p. 121.

Range in depth.— From 2,387 to 2,871 feet.

Lucina floridana.

Syn. *L. floridana* Con., Am. Jr. Sci., 1833, vol. 23, p. 344.
L. floridana Har., 4th Ann. &c., p. 121.

Range in depth.— From 2,236 to 2,871 feet.

CARDIUM.

Cardium galvestonense, n. sp. Pl. 1, fig's 3, a.

Syn. *Cardium*, sp. nov., Har., 4th Ann. Rep., &c., p. 121.

Specific characterization.-- Form as indicated by the figures; surface marked by about 19 strong ribs, beautifully striated on their sides and in the interspaces with even, sharp concentric lines and bearing on their summits a row of strong pustules, except in the vicinity of the umbones.

This species is in many respects intermediate between *haitense* Sowerby and *antillarum* d'Orb. From the former it differs in having fewer ribs, in being not quite so oblique or elevated; from the latter it differs in having about one more rib, in having the ribs of more nearly equal size, in having a comparatively longer posterior margin, and in having a more nearly rectangular outline.

Range in depth.—From 2,443 to 2,871 feet.

Cardium sp., probably *magnum* Born.

Range in depth.—From 2,552 to 2,600 feet.

VENUS.

Venus, fragments, doubtless of some of the large varieties of *mercenaria* common in the upper Miocene, Pliocene and recent formations.

Range in depth.—From 2,236 to 2,600 feet.

CHIONE.

Chione ulocyma.

Syn. *Venus ulocyma* Dall, Coll. U. S. Nat. Mus., MS.
Chione, n. sp., Florida Miocene form, Harris, 4th Ann. Rep. Geol. Surv. Tex., p. 121.

So far as I am aware this species has never been described. It has somewhat the form of *C. cancellata* though rather more sharply triangular; the concentric lirations are rounded and close-set on the face of the valves but both anteriorly and posteriorly change in character and become irregularly lamelliform; numerous radiating lines pass over the rounded concentric rugæ; margin within finely and sharply crenulate.

This species was first collected by F. Burns from the upper fossiliferous bed at Alum Bluff, western Florida. It is therefore an upper or Yorktown Miocene form.

Range in depth.—From 2,236 to 2,650 feet.

Chione cancellata.

Syn. *Venus cancellata* Lin., Syst. Nat., 12th ed., 1767, vol. 1, p. 1,130.

Range in depth.—From 1,550 to 2,871 feet.

DONAX.

Donax carinata var. *galvestonensis.*

Syn. *D. carinata* Har., 4th Ann. &c., p. 121.

Inhabiting the western coast of Mexico and Central America is another form resembling somewhat closely *D. carinata* and mistaken for it by Reeve —Conch. Icon. vol. 8, pl. 2, fig. 11— but which in fact is quite distinct. It is devoid of the peculiar sharp carina bordering the posterior slope, has no granules on the radiating striæ of this slope, and is devoid of the broad radiating color bands.

The Galveston well specimens are not so sharply carinate as *carinata*, but have the granulated radii of that species. Variety *galvestonensis* is somewhat intermediate between these two living species.

Range in depth.—From 2,552 to 2,920 feet.

Donax tumida.

Syn. *D. tumida* Phil., Rœmer's Texas, 1849, p. 453.
D. tumida Har., 4th Ann. &c., p. 121.

Range in depth.— From the surface to 458 feet.

STRIGILLA.

Strigilla galvestonensis n. sp. Pl. 1, fig. 4.

Syn. *Strigilla* near *pisiformis* Har., 4th Ann. &c., p. 121.

Specific characterization.-- This small *Strigilla* is somewhat allied to *pisiformis* Lin., but is less inflated especially about the umbones, is fuller on the anterior submargin, and its beaks are slightly inclined to point backwards instead of forwards.

Range in depth.— From 2,552 to 2,733 feet.

ABRA.

Abra æqualis.

Syn. *Amphidesma æqualis* Say, Jr. Phila. Ac. Nat. Sci., 1822, p. 307.
Syndosmya æqualis Har., 4th Ann. &c., p. 121.

Range in depth.-- From the surface to 900 feet.

RANGIA.

Rangia cuneata var. *galvestonensis*, nov. var. Pl. 2, fig's 1, a, b.

Syn. *Gnathodon* (nearest *cuneatus*) Har., 4th Ann., p. 121.

Variety *galvestonensis* differs from the typical form by having a less angular outline, by being less carinated from the umbones to the posterior termination, and by having the beaks less distant. Some specimens, however, are very close to *cuneatus*; the teeth in all are the same.

Range in depth.— From 1,510 to 2,920 feet.

Rangia? quadricentennialis, n. sp. Pl. 2, fig's 2, a, b, c.

Syn. *Gnathodon*, n. sp., Har., 4th Ann., &c., 1893, p. 121.
Spisula? quadricentennialis Dall, Proc. U. S Nat. Mus. vol. 17, 1894, p. 105.

Specific characterization.— Shell elliptical in outline as figured; thin; surface nearly smooth, except on the broadly rounded umbonal ridge the concentric striæ are more or less prominent in old specimens; a faint, broad sinus extends from beak to base; teeth of the right valve shown in fig. 2 a, those of the left in 2 c. Fig. 2 b represents the shell as it usually appears, the hinge plate being nearly always broken away.

Range in depth.— From 2,100 to 2,249 feet.

Type.— Texas State Museum.

MACTRA.

Mactra lateralis.

Syn. *M. lateralis* Say, Jr. Ac. Nat. Sci. Phila., vol. 2, 1822, p. 309.
M. lateralis Har., 4th Ann. &c., p. 121.

Range in depth.— From 300 to 2,920 feet.

Mactra quadricentennialis, n. sp. Pl. 2, fig's 3, a, b.

Syn. *Mactra*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.— General form cuneate as figured; hinge as shown in fig's 3, 3b; substance of the shell either thin and showing but slight traces of muscular scars within, or slightly thickened and showing the muscular scars and a small pallial sinus. A ridge extends from the umbones to the posterior margin; a less marked though observable ridge extends from the umbones to the anterior margin.

Range in depth.— From 2,236 to 2,871 feet.

LABIOSA.

Labiosa canaliculata.

Syn. *Lutraria canaliculata* Say, Jr. Ac. Nat. Sci. Phila., vol. 2, 1822, p. 311.
Labiosa canaliculata Har., 4th Ann. &c., p. 121.

Range in depth.—From 46 to 2,871 feet.

CORBULA.

Corbula galvestonensis, n. sp. Pl. 2, fig's 4, a.

Specific characterization.—This little round *Corbula* belongs to the same section as *disparilis* d'Orb. and *krebsiana* C. B. Ad., but differs from the latter in being less produced posteriorly, and from the former in the lack of an umbonal carination. The last mentioned feature gives *disparilis* a biangulate posterior margin while the corresponding margin of this species is strongly arcuate.

Range in depth.—From 2,443 to 2,650 feet.

Corbula (*Potamomya*) *priscopsis*, n. sp. Pl. 2. fig's 5, a.

Specific characterization.—General form as indicated by the figures ; apex acute ; a ridge traversing the umbonal slope radially ; a monoclinal ridge (sloping posteriorly) extending from beak to anterio-basal margin ; hinge teeth characteristic of this sub-genus.

Unfortunately but one specimen of this peculiar form was obtained. It resembles *prisca* Mart. from southern Brazil.

Range in depth.—From 2,443 to 2,448 feet.

Corbula swiftiana? Pl. 2, fig. 6.

Syn. *C. swiftiana* Ad., Cont. to Conch., 1852, p. 236.
Corbula, sp. undt., Har., 4th Ann. &c., p. 121

There are several recent so-called species inhabiting the southeast coast of the United States and the West Indian shores, and others the western coast of South and Central America that can scarcely be distinguished from this species when large numbers of specimens are brought together. *Swiftiana* of the West Indies is unhesitatingly referred by Arango (Faun. Mal. Cub., 1878, p. 253) to *nasuta* Sby. from the west coast of U. S. Columbia. Dall however in Bull. 37, U. S. Nat. Mus., 1889, p. 70 restores *swiftiana* to specific rank, also admits the presence of *nasuta* on our eastern coast. The Texan forms resemble most nearly immature specimens of *swiftiana* as understood by Dall in the work just cited, pl. 2 fig. 5a, though some specimens have an outline closely approximating pl. 1, fig. 6. On page 70 of the same work the latter is styled *contracta* Say while in Bull. Mus. Comp. Zool., vol. 12, p. 314 it is called *kjoeriana* Ad. Finally, these Texan well specimens do not differ widely from *nasuta* Con., from the Claiborne sands; they all belong to the same section of the genus.

Conrad's *nasuta* must give place to Lea's *alabamiensis*. It may also be observed here that Hinds' name *cuneata*, 1843, must be replaced by another for Say described a *C. cuneata* in 1824.

Range in depth.-- From 300? to 2,920 feet.

PHOLAS.

Pholas costata.

Syn. *P. costata* Linn., Syst. Nat., 10th ed., 1758, p. 669.

A careful description and fine figure of this species will be found on pp. 36 and 37 of Gould's report on the Invertebrata of Massachusetts, 2nd ed., 1870. See also Bull. U. S. Nat. Mus., No. 37, pl. 68, fig. 9.

Range in depth.— From 2,410 to 2,476 feet.

SCAPHOPODA.

DENTALIUM.

Dentalium tetragonum.

Syn. *D. tetragonum* Sby., Thes. Conchyl., 1860, p. 103.
D. tetragonum var. Har., 4th Ann. &c., p. 121.

Range in depth. – From 2,158 to 2,920 feet.

Dentalium quadrangulare?

Syn. *D. quadrangulare?* Har., 4th Ann. Rep., p. 121.

This species is figured in Thes. Conchyl., pl. 2, fig. 31. It is quite evident that the figure represents a young individual. The Texan specimens whether of this species or not may be characterized thus: Moderately tapering; smooth and square at the minor aperture, the angles slightly intensified by a heavy raised line on each; thick; below, four more angulations appear making the shell octagonal; still lower the interspaces are surcharged with ribs or striæ so that at base the shell shows 16, 32 or even 64 ribs.

Range in depth. – From 2,465 to 2,871 feet.

GASTROPODA.

ACTAEON.

Actæon galvestonensis, n. sp. Pl. 3, fig. 1.

Syn. *Actæon* nearest *punctostriatus*, Har., 4th Ann., &c., p. 121.

Specific characterization.—General form as indicated by the figure; whorls about 5, the upper nearly or quite smooth, below however there is a subsutural spiral line while the greater part or all of the body whorl is covered by spiral striæ showing a tendency to alternate in size; columellar fold strong; substance of the shell moderately thick.

This species has much in common with *lineatus* Lea of the Claiborne sand, but is more nearly related to *punctostriatus* Ad., from which it differs in thickness, position and size of columellar fold, and height. *A. cubensis* is striated somewhat like this but it is much shorter.

Range in depth. — From 2,552 to 2,871 feet.

Type.—Texas State Museum.

TORNATINA.

Tornatina bullata.

Syn. *Tornatella bullata* Keiner, Spec. Gen., p. 5, pl. 1, fig. 4. *Fide* Moerch.

Cylichna sp. Har., 4th Ann. Rep., p. 121.

Range in depth.— From 2,410 to 2,425 feet.

Sub-genus *Cylichnella.*

Cylichnella bidentata var. *galvestonensis*, n. var. Pl. 3, fig. 2.

For a good figure of this species see Bull. U. S. Nat. Mus., No. 37, pl. 41, fig. 14. The Texan specimens are slightly more globose, with a tendency to increase in size upwards instead of downwards; moreover its columellar plications are stronger than those of *bidentata.*

Range in depth.—From 2,600 to 2,733.

VOLVULA.

Volvula sp.

Syn. *Volvula* close to *cylindrica*, Har., 4th Ann. &c., p. 121.

This is a long slender form with a thin shell faintly striated spirally at base. It differs from *oxytata* Bush from our eastern coast by its greater length, narrower form, and thinner shell. It may be only a variety of *cylindrica* Gabb, a West Indian Miocene form even longer than this, but Gabb's name is preoccupied by Carpenter's *cylindrica* from the western coast.

Range in depth. —From 2,552 to 2,650 feet.

TEREBRA.

Terebra concava.

Syn. *Turritella concava* Say, Jr. Phila. Ac. Nat Sci., vol. v, 1826, p. 207.
Terebra concava Har., 4th Ann. Rep. p. 121.

Range in depth.— From 2,552 to 2,920 feet.

Terebra dislocata . Pl. 3, fig. 3.

Syn. *Cerithium dislocatum* Say, Jr. Phila. Ac. Nat. Sci., vol- 2, 1822, p. 235.

Range in depth. – From 2,158 to 2,920 feet.

Terebra langdoni. Pl. 3, fig. 4.

Syn. *Terebra langdoni* Dall, Proc. U. S. N. M., v. 18, p. 45.
Terebra, Chipola form, Harris, 4th Ann. Rep.. p. 121.

Dall's description.— Shell small, slender, of 13 whorls besides the nucleus which is small, conical and of three whorls ; sculpture reticulated transversely by 16 low, narrow, rounded, slightly flexuous ribs with wider interspaces, the posterior ends of the ribs not cut off by the deep sulcus which defines the sutural band in front ; transverse sculpture of this sulcus visible between the ribs and four flattish spirals, separated by narrow grooves, between the sulcus and the next suture, and seven or eight narrow spirals on the base ; aperture longer than wide ; pillar simple, smooth, canal rather long, twisted and recurved. Length 20, maximum diameter 4 mm.

As a rule the Texan forms are somewhat stouter than those from Florida and the number of plicæ is about eighteen.

Type of the species.—U. S. Nat. Museum.

Specimen figured.—Texas State Museum.

Range in depth. – From 2,158 to 2,920 feet.

Terebra galvestonensis, n. sp. Pl. 3, fig. 5.

Syn. *Terebra*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.— General form as indicated by the figure; apical 3 whorls smooth, remaining 9 or 10 marked as follows: Each whorl with (*a*) about 12 longitudinal costæ, narrower than the interspaces, (*b*) a deeply incised line about one-third way from upper to lower suture, (*c*) a faint spiral line near the base of each whorl; (*d*) several spiral lines on the basal portion of the body whorl. The spiral line referred to under (*c*) seems to vanish on the penultimate whorl after passing the longitude of the upper margin of the aperture. Two spiral lines, *i. e.*, the one corresponding with the suture and the one just below, are here and elsewhere on the body whorl particularly prominent. The columellar fold is plainly biplicate. As in the preceding species the plicæ on the different whorls are generally in line, but in contradistinction to that species the lines in this swing to the right or backwards in passing from apex to base.

Range in depth. – From 2,387 to 2,871 feet.

CONUS.

Conus puncticulatus. Pl. 3, fig. 6.

Syn. *C. puncticulatus* Hwass, Enc. Meth.- *Fide* Reeve.

There are several so-called species of *Conus* on either side of the Isthmus of Panama that are closely allied to this. The good specimens are nearly always immature; they are generally more strongly grooved at base than typical *puncticulatus* is, hence they resemble closely *pygmæus*; but the general form, crenulations and fragments of adult shells indicate a closer relationship with the former.

Range in depth.— From 2,236 to 2,920 feet.

PLEUROTOMA.

Pleurotoma albida.

Syn. *P. albida* Perry, Conchology, 1811, expl. of Pl. 32, fig. 4.
P. albida Harris, 4th Ann. &c., p. 121.
See Trans. Wag. Fr. Inst. Sci., vol. 3, 1890, p. 28.

Range in depth.— From 2,158 to 2,920 feet.

Pleurotoma (*Drillia*) *quadricentennialis*, n. sp. Pl. 3, fig. 7.

Syn. *Pleurotoma*, n. sp., Har., 4th Ann. Rep., p. 121.

Specific characterization. -- General form as indicated by the figure; whorls 8; 1 and 2 smooth; 3 longitudinally costate; the remaining whorls seven-costate, the costæ on the different whorls being arranged in line; slit very close to the suture; body whorl with numerous faint spiral lines; beak long and but slightly deflected.

Range in depth.— From 2,717 to 2,733 feet.

Pleurotoma (*Cithara*) *galvestonensis*, n. sp. Pl. 3, fig. 8.

Syn. *Cithara*, n. sp., Har., 4th Ann. Rep., &c., p. 121.

Specific characterization.-- General form as indicated by the figure; whorls 6 or 7; 1 and 2 smooth, very small; remaining whorls increasing in size rapidly, 7 - 10 costate, with incised lines noticeable especially on the body whorl; spiral lines most pronounced on the summits of the ribs and on the middle and lower part of the body whorl; every fourth or fifth line often noticeably deep; aperture about two-thirds the length of the whole shell; labrum thickened both without and within. A tooth-like projection is often present in old specimens on the labrum not far from the upper termination of the aperture.

Range in depth.—From 2,236 to 2,871 feet.

CANCELLARIA.

Cancellaria clavatula. Pl. 3 fig. 9.

Syn. *C. clavatula* Sby, Proc. Zool. Soc. Lond., 1832, p. 52.
C. clavatula Har., 4th Ann. &c., p. 121.

Range in depth.—From 2,552 to 2,600 feet.

Cancellaria reticulata Lin., var. Pl. 3, fig. 10.

Syn. *C. reticulata*, var., Har., 4th Ann. &c., p. 121.

The well specimens are comparatively small and are doubtless young. *Reticulata* proper is apt to have a more noticeable subsutural shoulder on the whorls than is shown on any of these specimens.

Range in depth.—From 2,158 to 2,920 feet.

Cancellaria galvestonensis, n. sp. Pl. 3, fig. 11.

Syn. *Cancellaria*, n. sp., Harris, 4th. Ann. Rep. Geol. Surv. p. 120.

Specific characterization.-- Size and general form as indicated by the figure ; whorls about 5 ; blunt at apex ; spire as a whole slightly convex ; longitudinal lirations varying considerably in strength, all comparatively weak ; spiral striation even, plainly visible though not deep ; aperture lirate within ; columella long, nearly straight, with two supra-medial strong plications ; umbilicus comparatively well developed.

Range in depth.-- From 2,552 to 2,600 feet.

OLIVA.

Oliva reticularis Pl. 3, fig. 12.

Syn. *O. reticularis* Lam., Ann. du Mus., vol. 16, 1810, p. 314.

Oliva literata Har., 4th Ann. &c., p. 121.

O. literata and *reticularis* are certainly very closely allied, and without the aid of the color markings their discrimination is difficult. The well specimens are referred to the latter species on account of their short spire and broad short form. See Reeve's figures.

Range in depth.—From 2,158 to 2,920 feet.

OLIVELLA.

Olivella galvestonensis, n. sp. Pl. 3, fig. 13.

Syn. *Olivella*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization. -- General form as indicated by the figure ; whorls about 5, smooth ; suture deep and prominent, well calloused as it approaches the aperture ; outer lip rather thin on the margin, with numerous lirations within ; inner lip with a callosity which extends to the suture of the penultimate whorl, and upon this callosity a second extending from the base upwards two thirds the length of the columella ; columella dentato-lirate, at base with a strong fold which follows up the axis of the shell to the apex, as seen in broken specimens.

Range in depth.-- From 2,410 to 2,871 feet.

Olivella subtexana, n. sp. Pl. 4, fig. 1.

Syn. *Olivella*, n. sp., Har., 4th Ann., &c., p. 121.

Specific characterization.—General form as indicated by the figure; whorls 6; columella well marked; a callosity extending upwards from the suture of the body whorl half way to that of the penultimate whorl; outer lip non-lirate within; inner lip with plications on the lower two thirds of its length, strong above and below but smaller medially.

Range in depth.—From 2,552 to 2,871 feet.

MELONGENA.

Melongena melongena.

Syn. *Murex melongena* Linn., Syst. Nat., 10th ed. 1758, p. 751.
Melongena melongena of various authors.

Range in depth.—From 2,448 to 2,465 feet.

NASSA.

Nassa galvestonensis, n. sp. Pl. 4, fig. 2.

Syn. *Nassa*, n. sp. near *ambigua*, Harris, 4th Ann. &c.

Specific characterization.— General form as indicated by the figure; whorls 6 or 7; 1, 2, and sometimes 3 smooth; below longitudinally, obliquely plicate and strongly spirally striate, the striations slightly enlarged on the plicæ; the latter on the body whorl from 10 to 13 in number, slightly smaller for some distance behind the thickened lip, all crossed by a more or less strongly marked subsutural line or depression; labrum thin at the margin but thickening rapidly without by a strong varix, striate within; labium well calloused, a spiral line or ridge above, extending to a sharp point below, canal extremely short.

Range in depth.—From 2,410 to 2,871 feet.

Nassa trivigalvesta, n. sp. Pl. 4, fig. 3.

Syn. *Nassa*, allied to *trivittata*, Har., 4th Ann. &c., p. 121.

Specific characterization. -- General form as indicated by the figure; whorls 7; 1 and 2 smooth, small; remaining whorls sculptured somewhat as in *trivittata* Say but appearing less coarse and granular, approaching *peralta* Con.; labrum rather finely lirate within; labium generally with no trace of a fold or line above.

Range in depth.— From 2,158 to 2,871 feet.

Nassa acuta.

Syn. *N. acuta* Say, Jr. Phil. Ac. Nat. Sci., vol. 2, 1822, p. 234.
N. acuta Har., 4th Ann. Rep., p. 121.

Range in depth.—From 440 to 2,871 feet.

PHOS.

Phos galvestonensis, n. sp. Pl. 4, fig's 4,5.

Syn. *Phos*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.-- General form as indicated by the figures; whorls 8; 1, 2, 3 smooth, very rotund; remaining whorls provided with rather narrow longitudinal ribs, crossed by even, rather strong spiral lines which increase slightly in size as they pass over the ribs; whorls slightly shouldered below the suture, and on the humeral zone there is one comparatively fine spiral line; one or two spiral lines of secondary order appear between the stronger ones on the middle of the body whorl; labrum well lirated within; labium sometimes with oblique, rather fine, raised striæ or plications; canal long, slightly twisted.

Range in depth.—From 2,158 to 2,871 feet.

Type of the species.—Texas State Museum.

COLUMBELLA.

Sub-genus Anachis.

Anachis obesa.

Syn. *Buccinum obesum* C. B. Ad., Proc. Bost. Soc. Nat. Hist., vol. 2, 1845, p. 2.
Columbella obesa C. B. Ad., Cont. to Conch., 1850, p. 55.
Anachis obesa Dall, Bull. Mus. Com. Zool., 18, pt. 2, 1889, p. 188.
Anachis obesa Har., 4th Ann. &c., p. 121.

Range in depth.—From 440 to 456 feet.

Sub-genus Strombina.

Strombina gibberula Sby, var. *galvestonensis*, n. var. Pl. 4, fig. 6.

Syn. *Strombina gibberula* Har., 4th Ann. &c., p. 121.

Variety *galvestonensis* differs from the typical specimens from the western coast of Central America in having a stouter body whorl in proportion to the spire. and in having a spire that sometimes shows signs of plications, very rarely as strong as indicated in the figure.

Range in depth. – From 2,410 to 2,871 feet.

SCALA.

Scala galvestonensis, n. sp. Pl. 4, fig. 7.

Syn. *Scala*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.—General form as indicated by the figure; whorls about 9, all very rotund and with exceedingly fine costæ inclining strongly to the left as they pass up and over each whorl; body whorl with a strong spiral line, a projection of the sutural contact.

Range in depth.— From 2,552 to 2,871 feet.

EULIMA.

Fragments of specimens belonging to this genus are common at various depths.

PYRAMIDELLA.

The specimens found may be characterized thus: whorls 11, smooth; suture deeply channelled; body whorl with a revolving line projected from the suture; columella with one strong medial plait, below which are often two or more subordinate ones especially in large specimens.

Range in depth.— From 2,410 2,473 feet.

ODONTOSTOMIA.

Odontostomia conoidea.

Syn. *Turbo conoideus* Brocchi, Conch. Foss. Subap., 2, p.

659, pl. 16, fig. 2.-- *Fide* Jeffreys.
Odostomia conoidea Jeff., Brit. Conch., vol 4, 1857, p. 127.
Odontostomia conoidea Har., 4th Ann. &c., p. 121.

Range in depth.-- From 440 to 458 feet.

BITTIUM.

Bittium galvestonense, n. sp. Pl. 4, fig. 8.

Syn. *Bittium*, allied to *annettæ*, Har., 4th Ann. &c., p. 121.

Specific characterization.-- General form as indicated by the figure; whorls about 7 ; apical 2 or 3 smooth ; below, strongly and regularly sculptured as follows : On each whorl four equal spiral lines, crossed by rather fine longitudinal ribs of about the size of the spiral lines ; labrum thin, but close behind it, a strong varix . This varix is occasionally found as far as one half whorl back of the mouth, but this is exceptional. Several varices are sometimes found on various portions of the spire. They often bend or change the axis of the shell and invariably obliterate the longitudinal sculpturing in their immediate vicinity.

This species resembles *annettæ* Dall somewhat but is at once distinguished by the number and equality of the spiral lines.

Range in depth.— From 2,550 to 2,871 feet.

Type.-- Texas State Museum.

CERITHIUM.

Cerithium galvestonense, n. sp. Pl. 4, fig's. 9,a.

Specific characterization.-- General form as shown by the figures ; whorls about 10 ; 1 smooth, remaining spiral whorls marked by numerous broad and rather obtuse longitudinal ribs crossed by spiral lines of varying size, finer above the supra-medial slight carination, coarser below, and at base strongly crenulate ; body whorl with a strong varix ; canal slightly bent to the left.

In old specimens the ribs, of the body whorl in particular, often project at the shoulder, forming blunt spines. In such cases the fine spiral striation of the humeral slope continues downward to the first crenulated line. There are in some instances two varices on the body whorl and occasionally they occur on the spiral volutions. Rarely all spiral lines are more or less granular.

Range in depth. – From 2,236 to 2,920 feet.

Type.--Texas State Museum.

Cerithium sp. *α*. Pl. 4, fig's 10,a.

Fragments distinguished from the preceding species by their more slender form, finer ribs, alternate and even striation, and lack of granulation. It will be observed also that in this species the ribs are prominent only above the middle of each whorl.

Range in depth.– From 2,236 to 2,871 feet.

Cerithium sp. *β*. Pl. 4, fig. 11.

Fragments resembling *galvestonense* in size and number of ribs but without a carination and granulations; basal stria of each whorl noticeably larger than the others.

Range in depth. -- From 2,236 to 2,920 feet.

Cerithium sp. *γ*. Pl. 4, fig. 12.

Fragments distinguished from the above by the gentle sloping humerel band, the non-alternate spiral striation, and the large spiral line just below the suture.

Range in depth. -- From 2,465 to 2,871 feet.

MODULUS.

Modulus modulus? Lin.

Small, imperfect specimens from depths of 2,552 and 2,871 feet.

TURRITELLA.

Turritella subgrundifera Dall, var.

The variety from the well inclines somewhat towards *tigrina* Kiener, now living on the western coast of Mexico, for the basal carina is not quite so prominent and the spiral striæ not so limited in number nor so even in size as in the typical form. Again, fragments indicate that this variety sometimes attains a considerably larger size than the type form.

Range in depth.— From 2,552 to 2,920 feet.

SOLARIUM.

Solarium granulatum.

Syn. *S. granulatum* Lam., An. sans Vert., vol. 7, p. 3.
" " Har., 4th Ann. Rep., p. 121.

Range in depth. – From 2,158 to 2,871 feet.

CRUCIBULUM.

Crucibulum near *auriculum* Gm.

Badly worn, small specimens.
Range in depth.– From 2,236 to 2,920 feet.

CREPIDULA.

Crepidula close to *convexa* Say.

All specimens immature.
Range in depth. —From 2,552 to 2,871 feet.

NATICA.

Natica canrena.

Syn. *N. canrena* Lam., An. sans Vert., vol. 6, 1822, p. 199.
" " Harris, 4th Ann. Rep.. p. 121.

Range in depth.— From 2,158 to 2,920 feet.

Natica duplicata.

Syn. *N. duplicata* Say, Jr. Phila. Ac. Nat. Sci., vol. 2, 1822, p. 247.
N. duplicata Har., 4th Ann. Rep. p. 121.

Range in depth.— From 2,158 to 2,920 feet.

Natica (*Lunatia*) *eminuloides.* Pl. 4, fig. 13.

Syn. *L. eminuloides* Gabb, Jr. Phila. Ac. Nat. Sci., vol. 8, 1878, p. 339, pl. 44, fig. 4.
L. eminuloides Har., 4th Ann. &c., p. 121.

Range in depth.— From 2,465 to 2,733 feet.

SIGARETUS.

Sigaretus perspectivus.

Syn. *S. perspectivus* Say, Amer. Conch., iii, 1831.

S. perspectivus Har., 4th Ann., &c., 1893, p. 121.

Range in depth.— From 2,552 to 2,600 feet.

NERITINA.

Neritina sp.

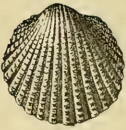
Small, eroded specimens ranging from 2,600 feet to 2,650 feet.

* * *

EXPLANATION OF PLATE I.

(**7**)

Fig. 1, a. *Arca labiata* Sby., var.................................. Page
.... (very young) longitude 7 mm.................... 7, **89**.
2, a, b. *Eriphyla galvestonensis*, n. sp. ; long. 4 mm... 8, **90**.
3, a. *Cardium galvestonense*, n. sp. ; long. 5.5 mm.... 9, **91**.
4. *Strigilla galvestonensis*, n. sp. ; long. 5 mm.........10, **92**.



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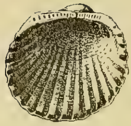

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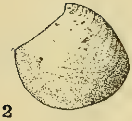

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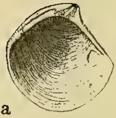

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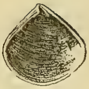

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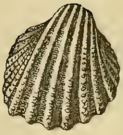

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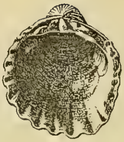

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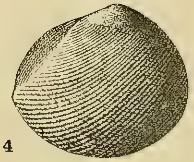

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EXPLANATION OF PLATE 2.

(**8**)

Fig. 1, a, b. *Rangia cuneatus*, var. *galvestonensis*,...... Page.
.... nov. var. ; long. 16 mm........................ 11, **93**.

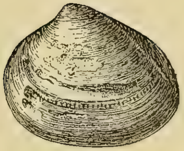
2, a, b, c. *Rangia quadricentennialis*, n. sp. ; ......
.........long. 13 mm.................................... 11, **93**.

3, a, b. *Mactra quadricentennialis*, n. sp. ; ....
.........long. 9 mm...................................... 11, **93**.

4, a. *Corbula galvestonensis*, n. sp. ; long. 5.5 mm.. 12, **94**.

5, a. *Corbula* (*Potamomya*) *priscopsis*, n. sp. ; ....
.........long. 13 mm.................................... 12, **94**.

6. *Corbula swiftiana?* Adm. ; long. 15 mm........... 12, **94**.



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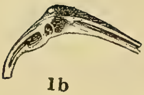

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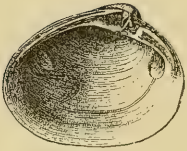

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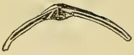

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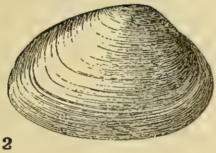

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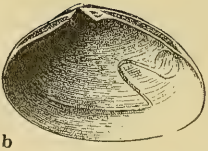

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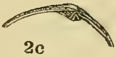

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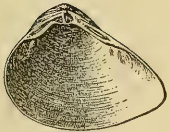

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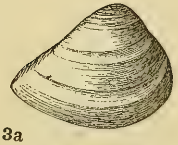

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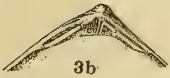

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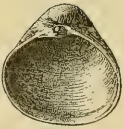

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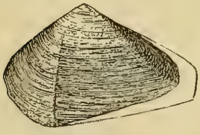

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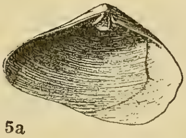

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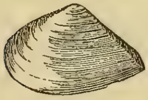

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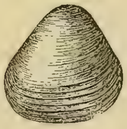


4a

EXPLANATION OF PLATE 3

(9)

Page.

Fig. 1. *Actæon galvestonensis*, n. sp. ; long. 5 mm.......... 14, **96**.

2. *Cylichnella bidentata* var. *galvestonensis*, n. sp. ;...... .... long. 5 mm.. 14, **96**.

3. *Terebra dislocata* Say, ; long. 24 mm..................15, **67**.

4. *Terebra langdoni* Dall ; long. 21 mm..................15, **67**.

5. *Terebra galvestonensis*, n. sp. ; long. 14 mm........ 16, **98**.

6. *Conus puncticulatus* Hwass, young, var. ; ....long. 20 mm.. 16, **98**.

7. *Pleurotoma* (*Drillia*) *quadricentennialis*, n. sp. ; .... long. 15 mm......................................17, **99**.

8. *Pl.* (*Cithara*) *galvestonensis*, n. sp. ; long. 10 mm.17, **99**.

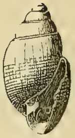
9. *Cancellaria clavatula* Sby. ; long. 13.5 mm......... 17, **99**.

10. *Cancellaria reticulata* Lin. (young); long. 16 mm. 17, **99**.

11. *Cancellaria galvestonensis*, n. sp. ; long. 15 mm... 18, **100**.

12. *Oliva reticularis* Lam. ; long. 22 mm............... 18, **100**.

13. *Olivella galvestonensis*, n. sp. ; long. 12 mm...... 18, **100**.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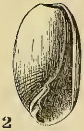
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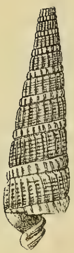
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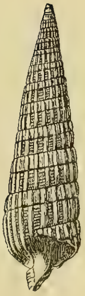
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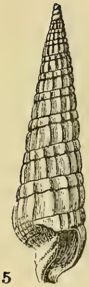
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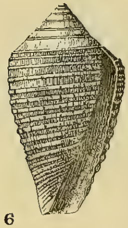
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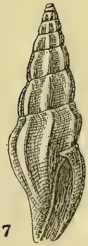
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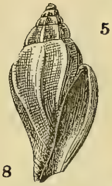
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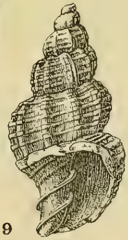
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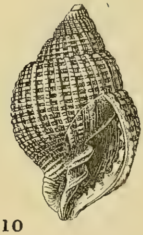
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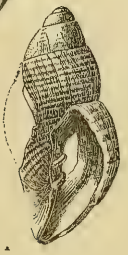
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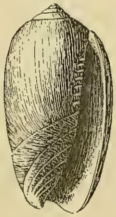
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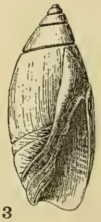
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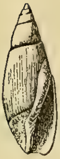
EXPLANATION OF PLATE 4.

(**10**)

Fig.		Page.
1.	*Olivella subtexana*, n. sp. ; long. 10.5 mm.	18, **100**.
2.	*Nassa galvestonensis*, n. sp. ; long. 7.5 mm.	19, **101**.
3.	*Nassa trivigalvesta*, n. sp. ; long. 10 mm.	19, **101**.
4.	*Phos galvestonensis*, n. sp. ; long. 13 mm.	20, **102**.
5.	The same, larger specimen ; long. 20 mm.	
6.	*Strombina gibberula* var. *galvestonensis*, n. var. long. 10 mm.	21, **103**.
7.	*Scala galvestonensis*, n. sp. ; long. 8 mm.	21, **103**.
8.	*Bittium galvestonense*, n. sp. ; long. 5.5 mm.	22, **104**.
9, a.	*Cerithium galvestonense*, n. sp. ; long. of 9, 18 mm. of 9a, 9.5 mm.	22, **104**.
10, a.	*Cerithium* sp. α ; long. of 10, 13 mm. of 10a, 16 mm.	23, **105**.
11.	*Cerithium* sp, β ; long. 12.5 mm.	23, **105**.
12.	*Cerithium* sp. γ ; long. 14 mm.	23, **105**.
13.	*Natica* (*Lunatia*) *eminuloides* Gabb ; long. 9 mm	24, **106**.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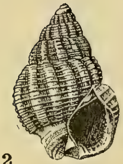
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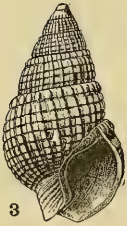
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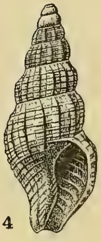
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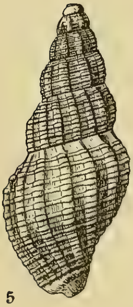
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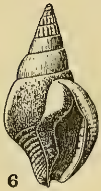
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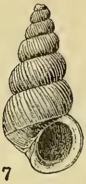
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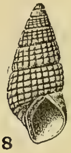
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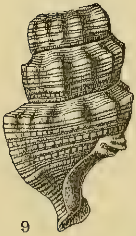
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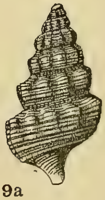
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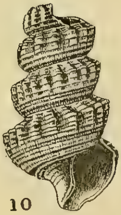
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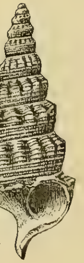
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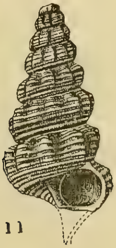
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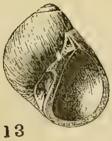
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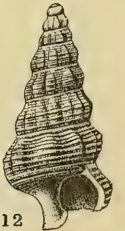
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Vol. 1

BULLETINS
OF
AMERICAN PALEONTOLOGY

No. 4

THE MIDWAY STAGE

BY

G. D. HARRIS

June 11, 1896

Cornell Univ., Ithaca, N. Y.
Harris Company

PLATE I.—Midway Beds Exposed at Palmer's Mill. *See pp. 31-32.*

THE MIDWAY STAGE.

BY

Gilbert D. Harris.

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PRELIMINARY CONSIDERATIONS.

Divisions of the Eocene.

The Eocene series of our Southern States has been provisionally sub-divided as follows:—

EOCENE SERIES {
6. Vicksburg stage.
5. Jackson stage.
4. Claiborne stage.
3. Lower Claiborne stage.
2. Lignitic stage.
1. Midway stage.

Aim and scope of this work.

The first or basal stage of this series is the Midway, and it is to this that we call attention in our present work. Part I is a brief sketch of the geological features of this terrane, as interpreted by former authors and by the present. These statements we believe will materially assist the beginner to understand certain passages found in different publications now quite at variance or diametrically opposed to each other. Part II is intended to include original descriptions, localities, whereabouts of types, figures, etc., of all well authenticated molluscan species known from the Midway.

Farther on we shall have occasion to call attention to the fact that between the basal Eocene deposits and the uppermost Cretaceous there is in this section of the country a decided break, both stratigraphic and faunal so that not one species is known certainly to have crossed from one formation to the other. At or immediately above this line an entirely new fauna makes its appearance upon the scene; whence it comes we cannot say, nor does it particularly concern us here, but its many subsequent modifications, and its decadence, and final merging into newer forms we hope to trace, if but imperfectly, during the following decade. With this evolutionary study we shall of necessity cull over, select out and re-publish all important paleontological facts heretofore published and hence do away with the greatest impediment to progress in our marine Tertiary faunas, namely, the scattered and almost inaccessible state of the literature.

Collection of fossils, field notes, etc., on which this work is based.

The Cornell University collection and the collectors' notes.—In the spring of 1895 the Trustees of Cornell University generously appropriated the sum of $400 to be expended in geological and paleontological research in the Tertiaries of our Gulf and Atlantic coast States. This sum was for defraying the field expenses of the writer and one assistant who were to volunteer their services during the following summer vacation in the field specified. Accordingly Mr. W. S. Hubbard and the writer left Ithaca in the latter part of June, and after visiting west Tennessee, northern and central Mississippi, central Alabama and western Georgia, returned North in the latter part of August. The collections made during this interval furnish what may be called the nucleus of the present work. They include not only fossils but sections and photographs of the more interesting or important localities. These may all be found catalogued and stored in the archives of the department of Paleontology of Cornell University.

It is scarcely necessary to say that during the summer season in the South it is often extremely warm, and trying to one's health; and the writer, as well as the University at large, is deeply indebted to the skill, strength, good-will and never-tiring zeal of Mr. W. S. Hubbard.

Dr. Jas. M. Safford's collection of types.—In the Journal of the Academy of Natural Sciences, vol. iv, 1860, p. 390, *et seq.*, Gabb published descriptions and figures of some fossils which he referred to as borrowed of Dr. Safford, State Geologist of Tennessee, who in turn obtained them from the "Ripley Group" of Hardeman Co., Tenn.

Through the kindness of Dr. Safford, the present writer has had the opportunity of seeing the type collection as sent to Gabb thirty-six years ago. A few are missing, but the privilege of seeing the remainder has been a great boon. They are all refigured herewith.

T. H. Aldrich's collection of fossils and drawings.—No one of late years has paid more attention to our marine Eocene paleontology than has Mr. Aldrich. His cheerful and prompt answers to inquiries, his transmission of fossils and all of the original drawings used in his article on the Midway fossils of Alabama published in a recent report by the Geological Survey of that State, have all tended to facilitate our present undertaking.

Collections of the U. S. National Museum.—All of the material collected ten years ago by L. C. Johnson in Hardeman Co., Tenn., and the interesting material from Oak Hill and Prairie Creek, Ala., have been transmitted by W. H. Dall of the Smithsonian Institution and the U. S. Geological Survey, and have been of great service to the writer. Mr. Stanton, of the Geological Survey, has also sent many fossils for inspection.

The author's works and field notes on this stage in Arkansas and Texas.—The results of the author's work on this terrane in Arkansas, are embodied in vol. ii, of the Ann'l Rep't Geol. State Survey of 1892. The Midway and other Tertiary molluscan remains of Texas were fully described and figured in a large monograph prepared to accompany the Fifth Annual Report of the State Survey; but appropriations failed and the work remains unpublished as a whole; the new species were brought out in 1895 by the Philadelphia Academy of Natural Sciences in the "Proceedings." A few field notes and many paleontological facts are published for the first time in the present work.

PART I. GEOLOGY.

BRIEF HISTORICAL SKETCH OF THE STUDY OF THE MIDWAY STAGE.

Period of 1834-1859.

Featherstonhaugh.—So far as we are aware, the first account of beds belonging to the Midway stage was given by G. W. Featherstonhaugh in 1835.[*] He says that at Little Rock, Arkansas, he "found a calcareous deposit containing marine fossil shells[†] belonging to the Tertiary beds. Three miles west of Little Rock, this deposit reappears in considerable quantities, and is quarried for the purpose of making lime."

Winchell.—The Midway beds about Allenton, Ala., and "eight and a half miles to the north" of that place were studied in 1853 by Prof. A. Winchell and published three years later.[‡] He placed them in his "Buff Sand" group and correctly referred them to the Eocene. The fossils he collected were placed in the hands of Prof. Tuomey for description; but unfortunately for science Prof. Tuomey soon died and the Tuscaloosa cabinets were destroyed by fire during the Civil war. Prof. Winchell did not realize any more than most of his successors that his "Prairie Bluff Limestone" on the Alabama river was composite. He regarded it all as Cretaceous.

Harper.—While State Geologist of Mississippi, Dr. Harper[§] mapped the Midway area in Tippah county and very correctly referred it to the Eocene, but drew extremely arbitrary boundary lines along its southern and western sides.

It will be noticed that in this period most observers of terranes belonging to what we now designate Midway, referred them to the Eocene series. We now are about to enter upon a period when for some unknown reason geologists and paleontologists were prone to refer such deposits to the Cretaceous.

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[*] Geological Report of an examination made in 1834 of the elevated country between the Missouri and Red rivers, by G. W. Featherstonhaugh, U. S. Geologist, published by order of both houses of Congress, Washington; printed by Gales & Seaton, 1835, 8vo, 97 pp. section. See p. 60.

[†] "*Ostrea, Turritella, Calyptrea, Cerithium, &c.*"

[‡] Proc. Amer. Ass. Adv. Sci., vol. x, 1856, pp. 89-90; Science, vol. iii, 1885, p. 32.

[§] Preliminary Report on the Geology and Agriculture of the State of Mississippi, by Dr. L. Harper, LL. D., Correspondent of the Imperial Museum for Nat. Science of France, etc., State Geologist of Mississippi. By order of the Legislature of Mississippi, E. Barksdale, State Printer, Jackson, 1857, 8vo, 350 pp., 7 pl., 1 map. See p. 36 and pl. 7.

Period of 1860-1883.

Hilgard.—In Hilgard's Geological Report of 1860* numerous references are made to the Midway deposits in Tippah Co. The limestone he refers to the Ripley Cretaceous, while the clays he regards as Lignitic or Lower Claiborne Eocene.

Gabb.—In the same year Gabb† described specimens from Hardeman Co., Tenn., sent him by Safford as Ripley fossils. They were all from localities near Middleton.

Safford.—In 1864 Dr. J. M. Safford published an article‡ "On the Cretaceous and Superior Formations of Tennessee." He gave therein an outline map and section showing the exact localities whence he obtained the fossils sent to Gabb, and regarded them all as Cretaceous. His Porter's Creek group he referred to the Tertiary with a query.

Loughridge.—In the reports of the 10th Census Mr. R. H. Loughridge recorded many geological observations. He noted (vol. v, 1882-3, p. 679) the occurrence of Tertiary fossils, now known to be of Midway age, in the Tehuacana hills of Texas.

On p. 280 of vol. vi, he gave a section of the bluff at Fort Gaines, Ga., and referred the Midway limestone in the same to the Claiborne stage.

White.—Dr. C. A. White called attention to a series of fossils sent to the U. S. National Museum (See Proc. of, vol. iii, p. 161), by Mr. Ulrich from near Little Rock, Arkansas. He regarded them as representing a Cretaceous fauna.

Later, Bull. No. 4, U. S. Geol. Surv., he made still further remarks on this fauna, describing some of the new species. They were still regarded as of Cretaceous age.

We see from the above that the observations on the Midway stage during this period were not many nor were the correlations made, accurate.

Period of 1884-1896.

Johnson.—Through the co-operation of the United States Geol.

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* Report on the Geology and Agriculture of the State of Mississippi, by Eug. W. Hilgard, Ph. D., State Geologist. Printed by order of the Legislature, E. Barksdale, State Printer, Jackson, Miss., 1860, 8vo, 391 pp., map and sections. See pp. 85, 87, 109.

† Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 389, *et seq.*

‡ Am. Jr. Sci., vol. xxxvii, 1864, p. 360.

Surv. and the Geol. Surv. of Alabama, Mr. L. C. Johnson was sent into the north Tertiary regions of Alabama and as early as 1883 (Science, vol. ii, p. 777; iii, p. 32) began to realize the fact that the Tertiary-Cretaceous border line was considerably farther to the north, in some localities at least, than was then generally conceded. In other words he re-discovered Winchell's discovery.

Smith.—However, the first publication containing anything like a satisfactory discussion of any section of the Midway stage, was that by Dr. Eug. A. Smith and L. C. Johnson, published as Bulletin No. 43 of the U. S. Geol. Surv., 1887.

We shall see hereafter how this classic work must be considerably modified in many ways to meet the demands of subsequent observations, but the main points in the stratigraphy of our lower Eocene are there well set forth.

Penrose.—While engaged on the Texas Geological Survey, Mr. R. A. F. Penrose (See 1st Ann'l Rep't Geol. Surv., Texas, 1889), described certain lower Eocene formations under the name of Basal or Wills Point clays. He made little or no attempt to accurately locate them in the scale of Eocene beds farther east.

Langdon.—In 1890, Mr. D. W. Langdon, jr., read before the Geological Society of America a paper entitled, "Variations in the Cretaceous and Tertiary strata of Alabama."* He therein gave many important facts regarding the Midway stage, particularly as it crops out along the Chattahoochee river. He corrected Loughridge's erroneous reference of the light-colored, impure limestone at the base of Ft. Gaines bluff to the Claiborne stage. The substance of this paper is repeated in Rep't Geol. Surv. Ala., 1894, p. 368, *et seq.*

Spencer.—In his First Report of Progress, 1891, Mr. J. W. Spencer, State Geologist of Georgia, published a geological map of the southwestern part of the State and indicated thereon the distribution of the Midway as well as other stages. A brief account is given on pages 44-46 of the Midway in this State. From a consideration of our own observations and collections about Americus and Andersonville, we are led to doubt the correctness of Mr. Spencer's conclusions regarding the Midway stage both as shown on the map and as expounded on the pages just referred to. However, another summer's work will determine matters more definitely.

Safford.—A very brief note was published by Dr. J. M. Safford in the Bulletin of the Geological Society of America, vol. iii, 1892, p. 511, on the "Middleton formation" of Tennessee, Mississippi and Alabama. He states that from specimens seen in a collection at Oxford, the site of the University of Mississippi, he was able to say that the beds whence they came, (Reeve's, Tippah Co.), are identical with deposits about Middleton, Tenn., and he proposes for them the name of " Middleton formation."

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*Bull. Geol. Soc. Am., vol. ii, pp. 587-606, July 8, 1891.

Judging from a letter received from Dr. Safford, Feb. 25, 1896, we conclude that it is the grayish, calcareous clays with green grains as exposed at Hannah's and Huddleston's near Crainesville, at Middleton, at Reeve's and at Blue Mt., that the Doctor would include in his newly named formation. The old localities, two miles east and two miles south of Middleton whence the Gabb specimens were derived, are not definitely correlated.

Harris.—The winter of 1891-2 was spent by G. D. Harris in studying the Tertiary of southern Arkansas. The results of this study were embodied in vol. ii, Ann'l Rep't Geol. Surv., Ark., for 1892; the report, however, was not published and distributed until June, 1894. The Midway stage of that State was therein discussed and several observations regarding the same formation in different States were moreover given. The writer called attention (l. c., p. 23) to the probable Midway age of the Tippah Co. rocks referred by Hilgard to the Silicious Claiborne. The Midway formation in Texas was identified by means of fossils obtained by the U. S. Geological Survey from near Webberville on the Colorado river and in Kaufman county.

Aldrich.—In the latter part of the summer of 1894, Mr. T. H. Aldrich published a short account of the Midway fauna of Alabama in the report for that year of the State Geologist. He described several new species as will appear later on.

In June, 1895, Mr. Aldrich published in Bull. Am. Pal., No. 2, several new molluscan species from the Eocene of Alabama. A few were from Matthews' Landing and hence from the upper part of the Midway stage.

STRATIGRAPHIC NOMENCLATURE.

Synonymy.

Beds now recognized as belonging to the Midway stage have hitherto been referred to as—

Buff Sand, Winchell, Proc. Am. Ass. Adv. Sci., vol. x, p. 89, 1856.

Basal or *Wills Point Clays*, Penrose, 1st Ann'l Rep't Geol. Surv., Tex., 1890, p. 19.

Black Bluff division of the Lignitic, Smith and Johnson, Bull. U. S. Geol. Surv., No. 43, p. 18, 1887.

Claiborne, Loughridge, 10th Census, vol. vi, p. 280, 1884.

Clayton, Langdon, Bull. Geol. Soc. Am., vol. ii, p. 594, 1891.

Clayton (*Midway*), Smith, Johnson, Langdon, Geol. Surv. Ala., 1894.

Cretaceous, White, Proc. U. S. Nat. Mus., vol. iii, p. 161, Bull. 4, U. S. Geol. Surv.

Eolignitic, Heilprin, Proc. Ac. Nat. Sci., Phila., 1881, p. 159.

Flatwood's Clays, etc., Hilgard, Agr. and Geol. Miss., pp. 110, 111, 1860.

?Hickman, Loughridge, Rep't Jackson's Purchase Region, 1888, p. 18, Geol. Surv. Ky.

Lignitic, Smith and Johnson, Bull. 43, U. S. Geol. Surv., 1887.

Lignitic or *Siliceous Claiborne*, Hilgard, Agr. and Geol. Miss., pp. 108, 109, 111 and map.

Matthews' Landing division of the Lignitic, Smith and Johnson, Bull. 43, U. S. Geol. Surv., 1887.

Middleton formation, Safford, Bull. Geol. Soc. Am., 1892, p. 511.

Midway division of the Lignitic, Smith and Johnson, Bull. 43, U. S. Geol. Surv., 1887, p. 18.

Midway, distinct from, and of co-ordinate rank with the Lignitic, Harris, Ann'l Rep't Geol. Surv. Ark., 1892, pp. 8, 9, 22.

Midway or *Clayton*, see *Clayton*.

Monterey, Langdon, Bull. Geol. Soc. Am., vol. ii, pl. 23.

Naheola division of the Lignitic, Smith and Johnson, Bull. 43, U. S. Geol. Surv., 1887.

Porter's Creek group, Safford, Am. Jr. Sci., vol. xxxvii, 1864, p. 368.

Ripley Cretaceous, Hilgard, Agr. and Geol. Miss., pp. 85, 87, 1860; Gabb, Jr. Ac. Nat. Sci., Phila., vol. iv, p. 389, 1860; Safford, Am. Jr. Sci., vol. xxxvii, 1864, p. 367; Langdon, Bull. Geol. Soc. Am., vol. ii, pl. 23, (Alabama river section).

Ripley formation, Smith, Johnson and Langdon, Geol. Surv. Ala., 1894, in Prairie Bluff and Pine Barren sections.

Sucarnochee or *Black Bluff* division of the Lignitic, Smith, Johnson and Langdon, Geol. Surv. Ala., 1894, p. 27.

Tertiary (*Eocene*), Featherstonhaugh, Geol. Rep't of the Elevated Country between the Missouri and Red rivers, p. 60. See also p. 39.

Usage of the term Midway.

Priority.—When looking over the above synonymy, one cannot help being impressed with the fact that *Midway* was the first unobjectionable term used to designate any considerable part of the series of deposits here under discussion; and which designated at the same time, within a fair degree of accuracy, their stratigraphic position in the Eocene scale.

The term *Buff Sand* is certainly objectionable for many reasons; other terms like *Flatwoods Clays* and *Porter's Creek group* were not sufficiently defined stratigraphically or paleontologically to merit permanent usage.

Location, geographically and stratigraphically.—Midway is the name of a plantation and landing on the west side of Alabama river about five miles below Prairie Bluff, in Wilcox county. It is said to have derived its name from the fact that river men regarded it as midway between Mobile and Montgomery. The beds exposed along the low bluff at this place consist of impure limestone ledges carrying rather sparsely at different places the "Turritella" and "Enclimatoceras" faunæ. These beds dip gradually to the south and where they reach the river's surface they are overlapped by black clays bearing the Black Bluff fauna. Down the river there is doubtless something like a hundred feet of clayey deposits above these limestone layers, while to the north and below there is nearly an equal amount of calcareous sand and clay. Hence the landing is accidentally in the medial part of the stage.

Differentiation from the Lignitic.—The writer made bold to suggest in his Arkansas report for 1892, (vol. ii, pp. 8, 9), that facts warranted the co-ordination of the terms Lignitic and Midway, *i. e.*, that the latter should no longer be regarded as a subdivision of the former. He also suggested including the Matthews' Landing and Black Bluff clays in the Midway stage. Further observation confirmed these views and in a subsequent publication (Am. Jr. Sci., vol. xlvii, p. 304, 1894) a tabular view of the Eocene beds was given. Practically the same he included in the fourth edition of Dana's Manual of Geology.

The publication of the State Geological Survey of Alabama in 1894 co-ordinated the two terms Lignitic and Midway, but limited the latter to the "Enclimatoceras limestone" and "Turritella limestone" and intermediate layers.

The Midway stage, a stratigraphic and paleontologic unit.—Having now studied this stage in six States, the writer feels at liberty to make a few suggestions as to what ought to be included within its limits, and what should be referred to preceding and what to subsequent stages.

We should take in all such cases some section or locality as typical, with which to compare all others. Perhaps the "Oak Hill–Pine Barren" section given in our description of the geology of Wilcox Co., Ala., will best serve this purpose. Bed 9, (Matthews' Landing horizon), is the first that can at present be positively located; for the lignitic sands above seem to be devoid of molluscan remains but suggest a close affinity with the Lignitic.

Besides many more or less characteristic Midway forms, the writer has collected from this horizon *Enclimatoceras ulrichi*, *Yoldia eborea*, *Venericardia alticostata* var., *Calyptrophorus velatus* var. *compressus*, all of which descend to the very base of the Midway, and *Isocardia mediavia*, found (rarely) in several Midway beds, and the peculiar type of *Volutilithes* so characteristic of this stage, including *V. limopsis*, *V. rugatus* var. *saffordi*.

The failure to recognize the Matthews' Landing horizon as belonging to the Midway is due to the lack of paleontological facts. To show how great the want of such information has been perhaps one example will suffice. In the Report of the Alabama Survey for 1894, p. 247, we find under *Enclimatoceras ulrichi* White, the statement, "Found only in the Nautilus rock," meaning thereby bed 17 of the section in question. Now that we have collected well-preserved, or at least specifically identifiable, specimens of this species through the whole stage, a range of about 200 feet, including nearly 100 feet of the so-called "Ripley Cretaceous" of that report, we realize that the field has not been very thoroughly surveyed either geologically or paleontologically, and hence we feel at liberty to follow the facts brought out by our own research regardless of statements published previously by others.

Lithologically the Midway beds are subject to rapid changes. We have seen a firm limestone grade out laterally within a few yards into an incoherent sand. What is black clay on one river is often represented by calcareous layers on another; but upon the whole the lower beds of the stage are sandy, clayey and calcareous, while the upper are generally clayey. The Lignitic above is characterized by lignitic sands.

GEOLOGY OF THE MIDWAY STAGE IN DIFFERENT STATES.

Texas.

Rio Grande section.—The exact limits of the Midway stage along the Rio Grande are not known. Its very existence may be questioned, yet from the few unsatisfactory fossils we have seen from there, and the publications of Messrs. Dumble* and Penrose,† we are inclined to believe that it reaches the river at a point about 3 miles below the Maverick-Webb county line.

Before passing to the Colorado river section we should note the peculiar fauna, Midway in part at least, found by Dr. White, 18 miles southeast of Eagle Pass. It consists of

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*Jr. of Geol., vol. ii, 1894, p. 555.

† 1st Ann'l Rep't Geol. Surv. Texas, 1890, p. 13.

"*Cucullæa macrodonta* [perhaps *saffordi*], *Pectunculus*, *Venericardia* [pl. 5, fig. 3], *Cardium* [pl. 6, fig. 3]." "The shelly matter of these species is completely crystallized." "The matrix was evidently a calcareous light sand or sandstone."—Harris, Ann'l Rep't Geol. Surv. Ark., vol. ii, 1892.

Colorado river section.—"Near Webberville, Travis county, on the Colorado river below Austin (Station 2438) Mr. Stanton found a clayey limestone more or less streaked with brown and yellowish shades but usually of a light yellowish hue. Chocolate colored, silicious pebbles, generally cuboidal in form, are often found in the more clayey beds. The enclosed shells, nearly always crystalline, are *Cucullæa macrodonta* [*saffordi?*], *Venericardia*, *Venericardia planicosta*, *Crassatella* [*C. gabbi*], *Lithodomus*, *Volutilithes?*, coral, sharks' teeth."

From a well at Elgin in the northern corner of Bastrop county, Mr. Dumble obtained *Volutilithes limopsis* and *Pleurotoma anacona.*—Harris, MS. Rep't on Tex. Tert.

Brazos river section.—On this river the contact of the Midway with the underlying Cretaceous is well exhibited in a bluff about where the southeast line of the Hogan Survey crosses the river, or perhaps 1½ miles above the Falls–Milam county line. This bluff is about 200 yards long and where the best outcrop occurs it shows at the base 14 feet of Cretaceous, containing *Baculities*, *et al.*, then 1 foot of material of doubtful age, and above, an unweathered bed of Eocene 4 feet thick with *Calyptrophorus velatus*, *Aporrhais* sp., *Turritella alabamiensis*, *Venericardia alticostata*, *Crassatella gabbi*, *Yoldia eborea.* Above this bed is one of yellow, weathered Eocene 1 foot thick; above are gravels and sands 3 feet in thickness.

About one-half mile below this bluff good exposures occur exhibiting *Ostrea pulaskensis*, *Enclimatoceras ulrichi*, *Calyptrophorus velatus*, *Cucullæa*, *Turritella alabamiensis*, *Yoldia eborea.*

A mile further down-stream or near the Falls–Milam county line there is a high bluff about ¼ mile in length which in some places contains numerous molluscan remains. In its upper portion yellowish sands prevail, then calcareous sandy layers appear, grayish in color, containing *Venericardia alticostata* and *Cucullæa macrodonta.* Below, the sands are bluish and clayey, and the lower portion of the bluff is composed of bluish black clays breaking with conchoidal fracture and containing *Calyptrophorus velatus*, *Cucullæa macrodonta*, *Crassatella gabbi* (see pl. 5, figs. 10 and 11), *Yoldia eborea*, *Turritella nerinexa.*

A few miles farther down-stream, at a locality heretofore spoken of as "2 miles above the mouth of Pond creek" and near the residence of Mr. Smiley, another bluff ¼ mile in length appears.

Its beds show a decided dip in some places while in others they appear horizontal. It is mainly composed of sandy material, specked with fragments of lignite and containing numerous calcareous boulders especially toward its northern end. Here, too, fossils were found from the water's edge to a height of about 11 feet. They are *Ostrea crenulimarginata*, *Leda milamensis*, *Cerithium penrosei*, *Pleurotoma ostrarupis*, *Pl. anacona*, *Fusus ostrarupis*, *Pseudoliva ostrarupis*, *Pseudoliva ostrarupis* var. *pauper*.

Falls county.—Farther east, in Falls county, the Midway limestone crops out along Salt Branch of Little Brazos river, on the Dennis Herald survey. About ½ mile above the confluence of the two streams, specimens of *Venericardia planicosta*, *V. alticostata*, *Enclimatoceras ulrichi* have been collected, and ½ mile still farther up the Branch, *Mesalia pumila* occurs.

Limestone county.—This county furnishes many Midway exposures and from them the members of the Texas Survey collected various characteristic fossils. A locality known as Horn Hill has furnished *Venericardia planicosta*, *Ostrea crenulimarginata*, *Modiola saffordi*, *Turritella humerosa* var. *eurynome* or *bellifera*.

In the vicinity of Tehuacana the limestone beds of the Midway aggregate at least forty feet. They are overlaid by yellowish and bluish, slightly argillaceous sandy layers which so far as observed are unfossiliferous. West of the College, say ½ mile, yellowish, calcareous sands occur forty-five feet or more below the base of the limestone and contain among many indefinite fossil remains fairly well preserved imprints of *Turritella mortoni* var. The same fauna is found in dense black clay, 1½ miles north of the College for a distance of 70 feet below the limestone. Other fragmentary specimens of *Pleurotoma*, *Nautilus?* and *Aporrhais* were seen here by the writer. Large calcareous boulders are of frequent occurrence in this horizon.

So far as known there are no specimens of *Cucullæa* in the immediate vicinity of Tehuacana, though several specimens of *Ostrea crenulimarginata* and *Turritella humerosa* var. have been collected. A large *Enclimatoceras ulrichi* in the College Museum is labelled *Nautilus danicus*.

The dip of this limestone formation varies considerably. In some instances it rises to a pitch of 45 degrees and is generally in a south-southeast direction.

Kaufmam county.—Going along the railroad from Wills Point westward for about two miles one finds some good exposures of laminated bluish and yellowish clays, calcareous nodules and boulders. Lignitic and micaceous specks are not uncommon. No fossils were here observed. Five miles west of Wills Point on Rocky Cedar creek the Midway limestone layers contain *Ostrea pulaskensis*, *Venericardia alticostata*, *Venericardia planicosta*, *Crassatella gabbi*, *Pleurotoma anacona*, *Pseudoliva unicarinata*, *Fulgurofiscus*.

From this county, at a station numbered 2440 in the U. S. Nat. Museum register and designated as four miles northeast of Kemp, Mr. Stanton collected *Cucullæa saffordi?*, *Cytherea*, *Venericardia planicosta*, *Turritella mortoni* and *Natica alabamiensis*, (Ann'l Rep't Geol. Surv. Ark., vol. ii, 1892, p. 33).

Arkansas.

Hot Springs county.—Passing into Arkansas, the first known fossiliferous Midway outcrop is to be found in the S. W. ¼ of S. 17, 4 S., 17 W. It contains among other less recognizable fossils *Cucullæa saffordi?*, *Turritella mortoni* and *Venericardia* sp. A well at the site of old Rockport passed through Midway limestone.

Saline county.—In the northeast corner of the northwest quarter of the northeast quarter of section 2, 3 S., 16 W., fossils are imbedded in a light bluish, sandy and clayey limestone and include *Ostrea pulaskensis*, *Cucullæa saffordi*, *Yoldia eborea*, *Nucula*, *Venericardia*, *Crassatella gabbi*, *Protocardia nicolletti* var., *Corbula subcompressa*, *Turritella humerosa?*, *Volutilithes limopsis?*.

In the northwest quarter of the northeast quarter of section 36, 2 S., 16 W., a very light yellowish sandy limestone furnished *Ostrea pulaskensis*, *Cytherea* sp., *Venericardia planicosta*, *Protocardia* sp., *Crassatella gabbi*.

In the northeast quarter of the southeast quarter of section 18, 2 S., 15 W., the following forms have been found: *Ostrea crenulimarginata*, *Yoldia eborea*, *Cytherea*, *Venericardia planicosta*, *Turritella multilira?* and a *Volutilithes*.

In a bluish, argillaceous limestone matrix, in the southeast quarter of the northwest quarter of section 15, 1 S., 14 W., *Ostrea crenulimarginata* and *pulaskensis* have been found.

From a highly ferruginous sandstone in the southwest quarter of the southeast quarter of section 9, 1 S., 14 W., fragments of casts of *Venericardia planicosta* and *Turritella mortoni* have been obtained.

Pulaski county.—Perhaps the best or most fossiliferous Midway exposure in Arkansas is one long ago described by Owen as on Fourche creek near the mouth of Crooked Creek, only a few miles southwest of Little Rock. This is in the northwest quarter of the southwest quarter of section 8, 1 S., 13 W., not far from Olsen's switch. Ulrich, Drake and Harris have collected fossils from this vicinity, and they have been described by Dr. C. A. White and G. D. Harris. The section here represented is as follows:—

a. Soil.	
b. Enclimatoceras limestone: yellowish and gray, more or less friable; exterior of fossils often stained brown by iron oxide; replete with *Enclimatoceras ulrichi*, varying in size from 1 to 12 inches in diameter,	18 inches.
c. Ostrea limestone: compact, light gray limestone, containing innumerable specimens of *Ostrea pulaskensis*,	3 feet.
d. Turritella limestone: light yellowish and gray, somewhat sandy; often honey-combed and cavernous, weathering very irregularly; at base especially, replete with *Turritella mortoni*,	8¼ feet
e. Sandstone ledge, light yellowish; formed apparently by infiltration of waters charged with calcite, into sand like that below,	2¾ feet.
f. White, compact sand, tinged yellowish on the exterior; contains scattering blue nodules. Exposed,	2 feet.
g. "Black slate, lying nearly horizontal; seen only at times of very low water."—Olsen.	

The molluscan species are *Enclimatoceras ulrichi*, *Ostrea crenulimarginata*, *O. pulaskensis*, *Cucullæa saffordi*, *Yoldia eborea*, *Crassatella*, *Venericardia planicosta*, *Protocardia*, *Cytherea* (*Dosiniopsis?*), *Corbula subcompressa*, *Tornatellæa* cf. *bella*, *Calyptrophorus velatus*, *Volutilithes* probably *saffordi*, *Pyrula*, *Mesalia alabamiensis?*, *Turritella mortoni*, *T. alabamiensis*, *T. multilira*, *Scala* sp., *Natica alabamiensis*.

Farther to the southwest about ½ mile a compact gray limestone appears in the bed of a stream just north of the railway track. This has furnished specimens of *Cucullæa saffordi*, *Cytherea* (*Dosiniopsis*), *Crassatella*, *Venericardia planicosta* (large), *Calyptrophorus velatus*.

In Little Rock, from Capitol Hill to the County Hospital, Midway limestone is frequently met with. The best collections made by the Arkansas Survey were from Johnson's well on Capitol Hill. Some were imbedded in light clayey, crystalline limestone, while others were from more yellowish and sandy layers. The forms identified are *Ostrea crenulimarginata*, *Cucullæa saffordi*, *Meretrix* sp., *Venericardia planicosta*, *Protocardia*, *Tornatellæa*, *Volutilithes* probably *saffordi*, *Mesalia alabamiensis*, and large typical *Turritella mortoni*.

Featherstonhaugh records from this limestone at Little Rock, *Ostrea*, *Turritella*, *Calyptrea*, *Cerithium*, *etc*.

Lonoke county.—In the vicinity of Cabot this limestone has been seen and it has furnished a few Midway species.

White county.—Again, perhaps 1¾ miles north of Bradford, a few Midway specimens have been collected in limestone quarries near the railway.

Jackson and Independence counties.—Three miles north of Bradford and at Grand Glaise extensive limestone exposures are found, but they are often rather barren. At present the existence of similar deposits beyond Bayou Departe are unknown.

Tennessee.

Omitting all discussion of deposits in Kentucky presumably of Midway age since they have not been studied by the writer personally, the first outcrops east of the Mississippi to receive special attention are those near Crainesville, Hardeman Co., Tennessee.

Vicinity of Crainesville.—About 1¾ miles north of this village there are several fossiliferous exposures near Mr. Hannah's house. In the yard and along the roadside in front of this house the following sequence of strata was noticed:—

a.	Sand bed clayey at base; highest Eocene deposits seen in the vicinity, - - -	10-20 feet.
b.	Whitish sandstone; fossiliferous, - -	8 inches.
c.	Clays, - - - - - -	10-15 feet.
d.	Clay-stone with green grains; *Venericardia* bed,	14 inches.
e.	Clay with peculiar sandstone concretions,	15-20 feet.
f.	Clay; gray and very fossiliferous above (*Leda*, *Tellina*, *etc.*); darker medially and almost black at base; lowest bed seen in the vicinity,	25 feet.

Bed *b* contains *Venericardia planicosta* var., *Calyptrophorus velatus*, *Enclimatoceras ulrichi*, *Protocardia* var. of *nicolletti*, *Ostrea pulaskensis*, *Cucullæa saffordi*, *Turritella mortoni*, *Crassatella gabbi*, *Modiola saffordi*, *Volutilithes rugatus* var. *saffordi*, *Yoldia eborea*, *Pholadomya mauryi* and several indeterminable fragments.

Bed *d* is evidently the one from which Johnson obtained his specimens for the U. S. National Museum about ten years ago. Casts of *Venericardia* probably var. *smithi* are extremely abundant in this bed.

Bed *f* is very fossiliferous in its upper part; among others it has furnished *Yoldia kindlei*, *Leda milamensis*, *Tellina* (pl. 6, fig. 8), *Corbula subcompressa* and *Tornatellæa quercollis?*.

Bed *e* just above the last mentioned is composed of clay in which there are numerous hard sandstone concretions. They vary greatly in size, and lie at all angles to the lines of bedding, being often vertical—dyke-like—through several feet of deposition.

Bed *f* when traced downward in the ditches at the side of the road represented in Fig. 1 becomes nearly black and shows a few poorly preserved specimens of *Turritella mortoni* var.

Though we went over a mile east of this locality we met with

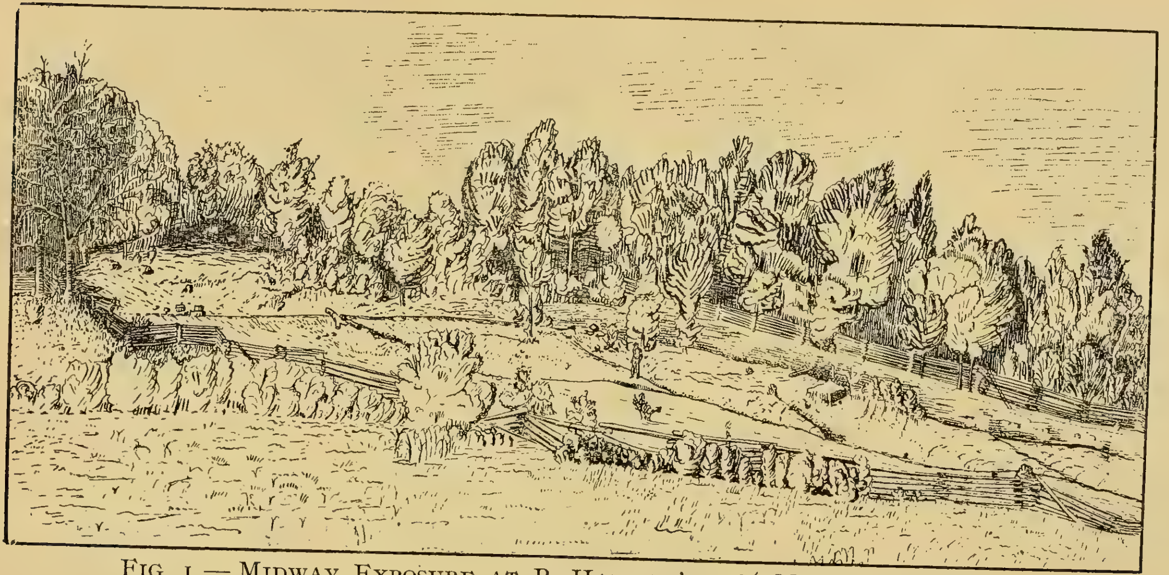

FIG. 1.—MIDWAY EXPOSURE AT R. HANNAH'S, 1¾ MILES NORTH OF CRAINESVILLE, HARDEMAN CO., TENN.

The hard ledge traversing the road is bed *d* of the section on p. 18.

no Cretaceous outcrops.

One-half mile southwest of Hannah's, bed *d* is well exposed and shows a local dip of about 1 foot in 20. The fossils obtained here consisted of casts; in fact, no fossils were collected by us in Tennessee which retained any considerable amount of their shelly substance. As nearly as we are able to determine such material, the species represented are *V. planicosta* var., *Crassatella gabbi*, *Calyptrophorus velatus* and what seems to be an internal impression of *Ostrea crenulimarginata*.

In and near the road at Mr. Huddleston's, 3 miles west of Crainesville, the following section was observed:

a.	White sandstone (fossiliferous),	1 foot.
b.	Clay,	20 feet.
c.	Clay-stone with green grains (fossiliferous),	2 feet.
d.	Clay,	15 feet.
e.	Clay-stone with green grains (fossiliferous),	1 foot.
f.	Clay,	?

It will be observed that the upper part of this section corresponds well with that at Hannah's and is doubtless its equivalent.

In the upper bed of the gray clay-stone with green grains the following forms were collected: *V. planicosta* var., *Ostrea pulaskensis*, *Pholadomya mauryi*, *Tellina*, *Cucullæa saffordi*, *Crassatella gabbi*, *Calyptrophorus velatus*, *Yoldia eborea*, *Natica* sp.

The clay layer "*d*" yields impressions of *Leda milamensis* and *Tellina* as bed "*f*" at Hannah's does.

Five miles south of Crainesville a hillside about 400 yards west of the highway is strewn in some places with ferruginous blocks of sandstone containing many impressions of *Venericardia* and *Pectunculus* (See pl. 4, fig. 3). The land is owned by Mr. Markham.

Middleton and vicinity.—Reference has already been made (p. 8) to the fact that as early as 1860 Dr. Safford sent Gabb of the Philadelphia Academy some fossils from the neighborhood of Middleton, Hardeman Co., Tenn. More particularly these fossils were derived from three exposures*; one, "a bed of buff gray, impure limestone from 2 to 6 feet thick. It is found on both sides of the railroad near Muddy creek." "It is doubtless the 'Turritella' and 'Bored' limestone of Hilgard's sections Nos. 12, 13 and 14; pp. 86-88." The other localities show "clayey sand with green grains," and are two miles east and about two miles south-southeast respectively from Middleton.

Safford following Gabb's identifications gives a list of fossils from these localities as follows,—*l* being the limestone exposure and *s* the clayey sand bed:

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* Safford's Geol. of Tenn., 1869, pp. 418-19.

1. *Corbula subcompressa* Gabb, - - - s.
2. *Venus ripleyana* Gabb, - - - *l*, s.
3. *Crassatella pteropsis* Gabb, - - - *l*, s.
   (Conrad had previously given this name to a species of *Crassatella;* Jour. Phila. Ac. iv, 279. I [Safford] therefore propose *C. gabbi* for it.
4. *C. monmouthensis?* Gabb, - - - s.
5. *Cardita subquadrata?* Gabb, - - - - s.
6. *Leda protexta* Gabb, - - - - s.
7. *Modiola saffordi* Gabb, - - - - *l*, s.
8. *Ostrea denticulifera* Con., - - - *l*. s.
9. *O. crenulimarginata* Gabb, - - - s.
   (If No. 8 is referred to the proper species, then *O. crenulimarginata* Gabb is, I [Safford] think, its lower or larger valve.
10. *Gryphæa vomer* Mort., - - - *l*.
11. *Turritella tennesseensis* Gabb, - - - s.
12. *T. saffordi* Gabb, - - - - *l*, s.
13. *T. hardemanensis* Gabb, - - - - s.
14. *T. pumila* Gabb, - - - - *l*, s.
15. *Natica rectilabrum* Con., - - - - s.
16. *Fasciolaria saffordi* Gabb, - - - s.
17. *Neptunea impressa* Gabb, - - - - s.
18. *Callianassa? gwyni* Safford, - - - *l*, s.
19. *Lamna gracilis?* Ag., - - - - s.
20. *Crocodilus?* (tooth) - - - - s.

"It will be seen that but two species of those given, *Gryphæa vomer* and *Natica rectilabrum*, are common to this group and the Green Sand. Localities in Mississippi, however, furnish series of fossils which unite the groups more intimately."

The *Gryphæa vomer* is doubtless an *Ostrea pulaskensis*, while the *Natica rectilabrum* is not the Cretaceous form described by Conrad under that name; this has been ascertained by a comparison of typical Cretaceous species from Mississippi with Dr. Safford's specimens. By referring to Part II of this Bulletin it will be seen what disposition has been made of the various molluscan species named above.

Specimens from Middleton station kindly forwarded by Dr. Safford show that the Crainesville horizon passes through this place, and, as we learn from other sources, passes through Tippah and Pontotoc counties in Mississippi. Dr. Safford's Middleton specimens include *Cucullæa saffordi*, *Meretrix ripleyana*, *Venericardia* var. of *planicosta*, *Turritella mortoni*, *Fusus hubbardanus*, *Calyptrophorus velatus and Levifusus trabeatus* var.

From Porter's creek Mr. Johnson obtained fragmentary specimens of what appear to be *Ostrea crenulimarginata*. He says on a slip of paper accompanying the specimens, "Extending from Middleton, Tenn., several miles westward lies the Porter's creek formation of Safford." Hence we are led to believe that the greater part of Safford's Porter's creek group belongs to the Midway.

The typical Crainesville–Middleton beds and fauna were found by Johnson at a locality designated as McDonald's mill, 4 miles southwest of Middleton. The various species he collected will be referred to in their proper places under Part II.

Mississippi.

Walnut and vicinity.—In crossing the Mississippi line going south from Middleton one finds the peculiar calcareous gray, green specked, hardened clays of the Crainesville horizon outcropping on the place described by Hilgard in his Agriculture and Geology of Mississippi, p. 112, as the Reeve place. This is about 2½ miles northwest of Walnut. Mr. Hubbard made a

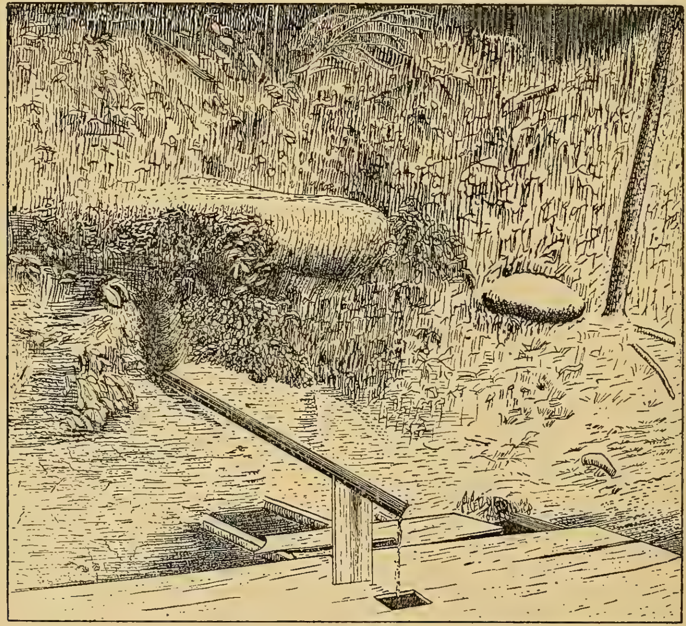


FIG. 2.— CHALYBEATE SPRING, TIPPAH CO., MISS.

collection here which included *Venericardia planicosta* var., *Cucullæa saffordi*, *Cassatella gabbi*, *etc.*

At Chalybeate, two or three miles east of Walnut, a Midway limestone appears bearing *Turritellæ* in abundance. The spring (Fig. 2) from which this place takes its name issues from immediately beneath this limestone or from the Cretaceous Owl creek marl. The limestone layer was not all seen in any one section, but did not appear to have a maximum thickness of over 10 feet. Ferruginous sands at least 20 feet thick were seen to overlie this limestone. In but one place in the vicinity were fossils observed in this arenaceous deposit. They consisted of very poorly preserved *Venericardia*.

Farther east, 1½ miles N. N. E. of Chalybeate, on Mr. Bobo's land it was observed that the Midway Turritella limestone was cemented below to a similar appearing rock, but replete with *Baculites* and many other typical Cretaceous forms. The dividing line between the two formations was indicated by a line of coarse pebbles. The lack of care in distinguishing between these two calcareous deposits may have caused Hilgard and others to regard the whole as Cretaceous.

Ripley and vicinity.—The sequence of Midway strata in the vicinity of Ripley is shown in the following section:

a.	Reddish sand, omnipresent.	
b.	Fine, crumbling bituminous shale, as seen on top of hill 1½ miles N. W. of Ripley, -	20 feet.
c.	Bed with *Venericardia et al.*, - - -	2-4 feet.
d.	Light gray and slate colored clay with conchoidal fracture, in places with a few fossils, (Memphis road, leading N. W. from Ripley,) -	75-100 feet.
e.	Light gray, indurated, residual clay containing fine, glauconitic particles, ½ mile N. of Ripley,	4-6 feet.
f.	Red, rather coarse sand. - - -	25 feet.
g.	The Turritella rock of Safford, ½ mile S. of Ripley, and also many points 1 to 2 miles E. of Ripley, resting on Owl creek marl, -	5-10 feet.

It may be here remarked that the Cretaceous group crops out nowhere in the village of Ripley, and its presence is known only from material obtained from wells dug to depths of 20 to 40 feet according to their location. Moreover almost the whole surface of the country for two miles farther east is of Midway Eocene. Hence the name *Ripley group* when applied to the uppermost Cretaceous is to some extent misleading. The famous Ripley (Owl creek) exposures are about 3 miles to the northeast.

At the forks of the road leading southward from Ripley, perhaps ½ mile south of the Court House, a bluff occurs made up of bed *g* and bed *f* commingled with bed *a*. Following the left fork of the road for a few yards a spring is seen issuing from beneath bed *f*. After a considerable amount of digging, Mr. Hubbard succeeded in finding traces of Cretaceous fossils in the underlying clay bed. The specimens collected from the limestone include *Venericardia planicosta*, typical and varietal, *Turritella mortoni*, *Cucullæa saffordi*, *Meretrix ripleyana*, *Yoldia eborea*, *Calyptrophorus velatus*, *et al.*

Bed *f* is well exposed in the streets along the eastern border of the village a few hundred yards east of the Court House.

Bed *e* is well exposed in the northern outskirts of the town, and our best collection of fossils was made in a pasture about ½ mile out and to the north. The collection includes *Levifusus hubbardi*, *Volutilithes rugatus* var. *saffordi*, *Turritella mortoni*, *Cypræa*, *Tornatellæa bella*, *Scaphella*, *Calyptrophorus velatus*, *Fusus quercollis*, *Fusus hubbardanus*, *Yoldia eborea*, *Venericardia* var. *smithii*, *Cucullæa saffordi* and *macrodonta?*.

Bed *d* is well exposed along the Memphis road from ½ to 1½ miles from Ripley. It contains a few fossils with shells in the condition of white powder but no large well preserved recognizable ones were noted.

On top of a high hill 1½ miles northwest of Ripley, bed *a* is well exhibited and on either slope a short distance from the summit there are traces of *Venericardiæ*—bed *c*.

At the roadside 1 mile east of Ripley Mr. Hubbard collected *Fusus tortilis?* and *Venericardia alticostata* Con. var., while 1 mile still farther east from a splendid exposure of bed *g* he obtained vast numbers of casts of *Turritella mortoni* along with *Calyptrophorus velatus* var. *Cucullæa saffordi*, *Venericardia planicosta*, *Meretrix ripleyana*, *Ostrea pulaskensis?* and many other less recognizable forms.

Blue Mountain, *i. e.* the Brougher place of Hilgard's report, is six or seven miles to the southwest of Ripley and furnishes a good Eocene section. The various beds exposed with rough estimates of thicknesses are as follows:

a. Top of hill. Ferruginous, large concretions in red sand.

b. 100 feet more or less of reddish sand.

c. Clay bed, perhaps 20 feet thick; being impervious to the waters percolating through *b* it gives rise to many noble springs, the best of which come forth just above the laundry of the flourishing Blue Mountain college.

d. Beneath *c* and around the steeper banks below the spring the first fossiliferous bed is found. It is the typical Crainesville gray calcareous clay with green grains and bearing *Venericardia* var. *smithii*, *Cucullæa saffordi*, *Tur-*

ritella mortoni var., *Meretrix ripleyana*, *Yoldia eborea*, *Protocardia and Enclimatoceras ulrichi;* 2 to 4 feet in thickness.

e. Nearly barren clay; perhaps 20 feet.

f. A repetition of bed *d*.

g. Clay as in bed *e*.

Pontotoc and vicinity.—Material of the same general appearance occurs in the highway from 1 to 2 miles west of Pontotoc; but owing to a slight indisposition on the part of the writer the day that was allotted to its examination, no collections of fossils were made. The exposures in the immediate vicinity of the station carry a typical upper Cretaceous fauna.

Alabama.

Black Bluff.—This bluff according to Smith and Johnson is in S. 12, 16 N., 1 W. (Bull. 43, U. S. Geol. Surv., 1887, p. 61). It is in places about 70 feet high, but as a rule furnishes few and imperfect molluscan remains. The specimens collected by the writer upon first visiting the locality are now in the State Museum at Austin, Texas. They contained a few forms more perfect than those obtained during last summer's visit, and owing to the absence of the State Geologist from Austin they are inaccessible at present. Our collection however shows *Enclimatoceras ulrichi*, *Cucullæa macrodonta*, *Yoldia eborea*, *Nucula mediavia*, *Meretrix* (large, fragment), *Tornatellæa bella*, *Volutilithes rugatus*, *Levibuccinum lineatum*, *Mitra hatchetigbeensis?*, *Olivella mediavia*, *Natica*, *Pleurotoma*, *Dentalium* and other less determinable fragments.

The black clays so characteristic of this exposure and general horizon continue on down the river for several miles, often furnishing a few well preserved fossils but never abundantly. At a locality about 4 miles below the bluff we collected *Enclimatoceras ulrichi*, *Cucullæa macrodonta*, *Yoldia eborea*, *Volutilithes rugatus* var. somewhat like *saffordi*, *Olivella mediavia* and many fragmentary specimens.

Among the molluscan remains in these Black Bluff clays one observes an abundance of coral and crab remains. One inorganic structure attracts attention on account of its pisolitic, light gray appearance. Dr. Gill of this University on testing one of these peculiar substances pronounced it Barite (Barium sulphate). Gypsum crystals are common in the clays; and springs which issue in abundance from many of the exposures are generally very sulphurous and their waters impotable.

Naheola.—Farther down the Tombigbee, at Naheola the black clays reach the water's edge, and the ferruginous green sand (often indurated) marl is most conspicuous. Immediately at the landing no well preserved fossils were found, but the outcrops perhaps 100 yards below furnished *Cucullæa macrodonta*, *Protocardia nicolletti* var. (large and perfectly preserved), *Astarte smithvillensis* var., *Venericardia alticostata* var., *Pecten alabamensis*, *Meretrix*, *Ostrea*, *Dentalium*, *Pseudoliva unicarinata*, *Volutilithes* var. *saffordi*, *Fusus mohri*, *Natica eminula*, *N. alabamiensis*, *Voluta showalteri*, *Cylichna* (pl. 7, fig. 7).

Prairie Bluff and vicinity.—Prairie Bluff on the Alabama has long been known as a typical upper Cretaceous collecting ground; and strange to relate, from the time of Winchell's visit in the fifties until ours of last summer the Eocene character of the surface rocks on this bluff and its immediate vicinity had never been detected. Smith and Johnson's general section of this locality as published in 1887, in Bull. 43, U. S. Geol. Surv. and 1895 in the State Survey report of that year is reproduced in this treatise along with the Oak Hill–Pine Barren section. Our interpretation of the same is therewith given.

Since this is one of the localities in this part of the State most frequented by collectors, we feel it not out of place to give a considerable number of details in its description.

Our general section taken from outcrops at the Bluff and many others from ½ to 2 miles to the north is given below:

Tops of highest hills to the north of Prairie Bluff. Sandy layers with some clayey limestone. One *Enclimatoceras* observed.	
a. Bluish clay with ledges of impure light or slightly yellowish limestone; fossils scarce,	15 feet.
b. Very much as in "*a*" but characterized by a *Lucina*,	30 feet.
c. Yellowish gray limestone with *Enclimatoceras*,	1 foot.
d. Bluish clay with bands of impure limestone containing *Enclimatoceras*,	20 feet.
e. Clayey and limy layer with *Enclimatoceras*, *Venericardia*, *Cucullæa*, *etc.*,	2-3 feet.
f. A continuation of bed "*e*" but becoming more clayey, calcareous and bluish above; below having the texture of brown sugar, or sandy and unfossiliferous, and finally pebbly with rolled *Belemnites* and *Exogyra* fragments,	8-12 feet.
g. Blue clay with Cretaceous fossils.	

The contact of the Midway and Cretaceous beds can be seen at the Bluff in the little channels that cut the surface rocks just south of the cotton storage shed. But the best and most fossiliferous exposures are to be found a mile or two from the landing.

To the north, about one mile, between the first and second hill the basal Eocene and the uppermost Cretaceous beds can be seen in an old field. Cretaceous beds in all instances occupy the brink of the bluffs, but a short distance inland, only a few yards in some instances, Midway beds appear. The uppermost bed of the Cretaceous that certainly has not been rehandled is a layer of hard, bluish micaceous clay about 7 feet thick, generally poor in fossils, resting on a bed replete with *Exogyra* and *Gryphæa*. Reposing unconformably upon the bluish clay layer is a bed of coarse granular friable sandstone; it is coarser below, with quartz pebbles, shark's teeth, rolled fragments of *Belemnites*, *Exogyra*, *etc.* Higher up, this bed grades into bed *e* which is an impure clayey limestone with many specimens of *Enclimatoceras ulrichi*, *Turritella mortoni*, *Crassatella* probably *gabbi*, *Cucullæa* probably *saffordi*, *Ostrea pulaskensis*, *Venericardia alticostata* var., corals, sharks' teeth, *Tubulostium*, *et al.*

In the fields between the second and third hill north of the Bluff it was seen that occasionally all the calcareous layers of bed *d* furnish specimens of *Enclimatoceras ulrichi*. Bed *c* where it outcrops in the highway at the foot of the southern slope of the first hill north of Prairie Bluff furnishes many specimens of this important fossil. On the summit of the third hill to the north, occupying a position 10 or 15 feet above bed *a*, some calcareous rock fragments were found which from their altitude we were inclined to regard as representatives of the limestone ledge seen at Midway. A very large *Enclimatoceras* was obtained from one of these fragments.

Going westward from the Bluff one passes off from the Eocene beds down into a slight depression and there finds numerous *Exogyræ* and other Cretaceous forms. Gradually ascending from this depression and carefully scanning the exposures in the road ditches one finds *Enclimatoceras* quite plentifully.

After going about ¾ mile west from the river along the Catharine road the Cretaceous–Eocene contact can be seen at the roadside. The Eocene bed contains practically the same fauna as that just described from 1 mile north of the Bluff. The fossils collected here are *Enclimatoceras ulrichi*, *Crassatella*, *Cucullæa*, *Ostrea pulaskensis*, *Venericardia alticostata* var., *Yoldia eborea*, *Turritella mortoni*, *Scala*, *Tubulostium*, sea-urchins, and sharks' teeth.

In a field about ⅓ mile northwest from the Bluff, bed *c* furnished *Pseudoliva scalina* and *Turritella nerinexa?*.

In the same old field a few hundred yards nearer the Bluff specimens were obtained of *Enclimatoceras ulrichi*, *Fusus* (large cast), *Turritella mortoni*, *Amauropsis*, *Crassatella*, *Cucullæa*, *Venericardia*, *Ostrea pulaskensis* and *O. crenulimarginata*.

In the hill just north of the Bluff numerous specimens of a *Lucina* were obtained. They are usually coated over with a calcareous clayey substance, and oftentimes more or less distorted. Owing to their imperfect state of preservation it is impossible to say for certain whether they belong to species already described or not. Similar specimens have been seen on the Brazos river as well as on the Tombigbee. Accompanying this species are *Enclimatoceras ulrichi*, *Turritella mortoni* var. and *Yoldia eborea*.

The Cretaceous–Eocene contact is well exhibited along Shell creek about 1½ miles southwest of Prairie Bluff. Fig. 3 shows in a general way the irregularity of the upper surface of the light blue Cretaceous sandy clay, and also the coarse pebbly character of the lower layers of the superincumbent arenaceous bed. A section from the bed of this stream to the level of the high land to the south is as follows:—

a. Limestone layers, - - - - 10? feet.

b. Bluish sandy and micaceous clays interspersed with calcareous ledges (beds *a*, *b*, *c* & *d* of the

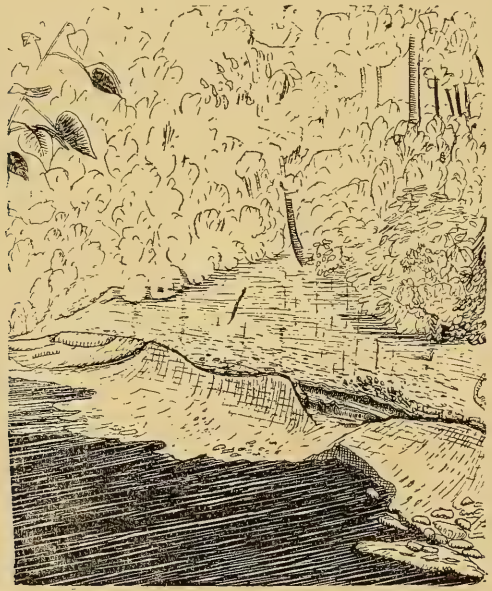


FIG. 3.—CRETACEOUS–EOCENE CONTACT, ON SHELL CREEK, ALA.

section north of Prairie Bluff), - - 80 feet.

c. Bluish sandy clay, somewhat indurated, with *Cucullæa saffordi* and *Ostrea pulaskensis* (bed *e* of section north of the Bluff), about - 7 feet.

d. Transition sandstone with pebbles and rolled fragments of Cretaceous fossils (bed *f* of section north of Prairie Bluff), - - - 10 feet.

e. Cretaceous sandy clay.

Midway and vicinity.—About half-way between the last mentioned exposure on Shell creek and Midway, in fields that are now under cultivation, shelly limestone outcrops appear here and there bearing many organic remains. Their state of preservation is not excellent, but by diligent search fairly good specimens may be found belonging to a large number of genera. In our field notes and in the Museum catalogues we have referred to these outcrops as 1 mile north of Midway. The following are the most numerous forms: *Enclimatoceras ulrichi*, *Venericardia planicosta*, *Venericardia* sp., *Ostrea pulaskensis* var., *Ostrea crenulimarginata* var., *Cucullæa saffordi*, *C. macrodonta?*, *Calyptrophorus velatus*, *Aporrhais*, *Isocardia mediavia*, *Protocardia*, *Tornatellæa bella*, *Volutilithes rugatus* var., *Turritella mortoni*, *Xenophora*, *Trochita*, *Fusus*, *Natica*, *Solarium* and *Mesalia pumila*.

At Midway a low limestone bluff appears on the west side of the river. It may be traced for several hundred yards up and down the river, but yields few well preserved organic remains. At its southern terminus, *i. e.*, where the limestone layers meet the water's surface, black clays appear resting directly upon the limestone and bearing fragmentary, yet determinable molluscan remains. While visiting this spot several years ago the writer noted *Cucullæa macrodonta*, *Dentalium*, *Yoldia eborea* and corals as at Black Bluff on the Tombigbee.

Matthews' Landing.—This is the place referred to long ago by Whitfield as 6 miles below Prairie Bluff on the Alabama river (Am. Jour. Conch., vol. i, 1865, pp. 259-268). Specimens obtained from here are often fragile, but when compared to those from the great majority of the other Midway specimens consisting only of casts, they must be regarded as extremely well preserved. Weathering seems to harden these friable specimens, and hence instead of digging, one finds it to his advantage to devote himself to hunting over weathered material along the whole outcrop. At a moderately low stage of the river the dark Midway clays form an escarpment about 10 feet above the water, level as a floor on top, with a length of perhaps 50 yards and a breadth of 10. On this level surface atmospheric agents year by year prepare large numbers of beautiful fossils for grateful collectors.

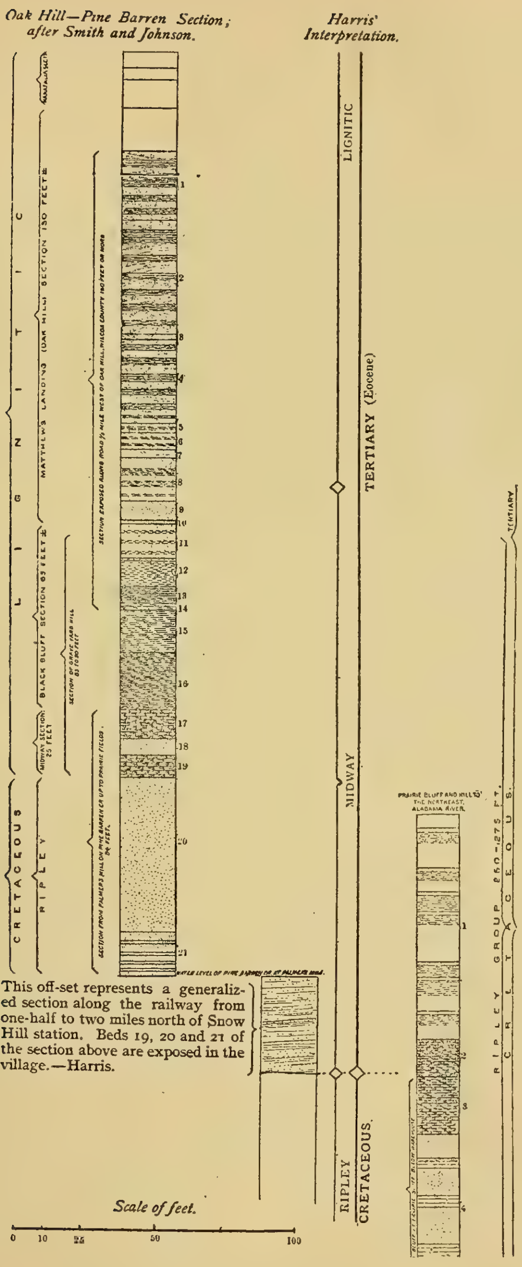
Our list of fossils from this locality is far less complete than it would have been had we not met with a serious accident at the moment of departure whereby many of our best specimens were lost in the river. Nevertheless our collection includes *Calyptrophorus velatus* var. *compressa*, *Corbula subcompressa*, *Cucullæa macrodonta*, *Exilia pergracilis*, *Fusus meyeri* var., *Fusus mohri*, *Fusus tortilis*, *Isocardia mediavia*, *Murex matthewsensis*, *Natica eminula*, *N. onusta?*, *N. perspectiva*, *N. reversa*, *Neptunea constricta*, *Olivella mediavia*, *Ostrea* sp., *Pecten alabamensis*, *Pleurotoma adeona*, *P. longipersa*, *P. ostrarupis*, *P. persa*, *Pleurotomella pagodiformis* var. *quercollis*, *P. whitfieldi*, *Pseudoliva unicarinata*, *P. vetusta* var., *Pyropsis perula*, *Pyrula juvenis*, *Solarium* sp., *Strepsidura heilprini*, *Triton showalteri*, *Trochus alabamensis*, *Turritella alabamiensis*, *Turritella mortoni* var. *levicunea*, *Venericardia alticostata* var., *Voluta showalteri*, *Volutilithes limopsis*, *V. rugatus*, *Yoldia eborea*.

Other species are known to have come from this exposure. First of all may be noted Whitfield's *Natica* (*Girodes*) *alabamiensis*, and his problematical *Velutina* (*Otina*) *expansa;* Dall figures and describes from here *Solarium alabamense* and *S. periscelidum;* Meyer, *Cadulus turgidus;* Aldrich, *Cylichna meyeri*, *Fulgur eocense*, *Rissoina alabamensis*, *Leucozonia biplicata*, *Levifusus suteri*. Moreover Aldrich adds to this list *Murex morulus*, *Pseudoliva scalina*, *Levifusus trabeatus*, *Levibuccinum lineatum*, *Melanopsis choctawensis* and other specimens identified simply generically.

Snow Hill and vicinity.—It is in this portion of Wilcox county that the typical Midway section as understood by us is to be found (See p. 31). On the summits of the slight elevations about Snow Hill station, fragments and sometimes large masses of limestone replete with *Turritellæ* may be seen. This we refer with little doubt to bed 19 of the section just cited. In the first shallow railroad cut north of the station *Ostrea crenulimarginata* is abundant and fairly well preserved in a bluish sandy, micaceous clay matrix. It is accompanied by a few-ribbed variety of *Venericardia alticostata*.

Farther north along the railroad, perhaps ½ mile, a second shallow cut is met with, having the same lithological appearance. Its fossils are not rare nor are they abundant or well preserved. They are nearly all in the form of casts, yet they admit of specific identification and are most important for correlation purposes. They include *Venericardia planicosta* (typical), *V. alticostata* (few-ribbed var.), *Ostrea crenulimarginata*, *Meretrix*, *Turritella mortoni* and *Volutilithes saffordi*.

Two miles north of the station, at Rock cut, about 25 feet


Oak Hill—Pine Barren Section; after Smith and Johnson.
Harris' Interpretation.
LIGNITIC
CRETACEOUS
MATTHEWS LANDING (OAK HILL) SECTION 150 FEET±
BLACK BLUFF SECTION 65 FEET±
MIDWAY SECTION 25 FEET
RIPLEY
SECTION EXPOSED ALONG ROAD ½ MILE WEST OF OAK HILL, WILCOX COUNTY 160 FEET OR MORE
SECTION OF GRAVE YARD HILL 65 TO 80 FEET
SECTION FROM PALMERS MILL ON PINE BARREN CR UP TO PRAIRIE FIELDS. 64 FEET.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
WATER LEVEL OF PINE BARREN CR. AT PALMERS MILL.
LIGNITIC
TERTIARY (Eocene)
MIDWAY
RIPLEY
CRETACEOUS.
PRAIRIE BLUFF AND HILL TO THE NORTHEAST. ALABAMA RIVER.
1
2
3
4
BLUFF AT PRAIRIE BLUFF
TERTIARY
RIPLEY GROUP 250-275 FT.
CRETACEOUS.
Scale of feet.
0
10
25
50
100

This off-set represents a generalized section along the railway from one-half to two miles north of Snow Hill station. Beds 19, 20 and 21 of the section above are exposed in the village.—Harris.

FIG. 4.

above the Cretaceous–Eocene contact more casts may be seen in a matrix very much like that indicated above. The following species are fairly abundant: *Enclimatoceras ulrichi*, *Calyptrophorus velatus* var., *Turritella humerosa*, *T. mortoni*, *Meretrix* probably *ripleyana* and *Venericardia alticostata.*

These exposures to the north of Snow Hill are indicated on p. 31 by bed 21 and the off-set as explained in the section.

Three and one-half miles northeast of Snow Hill and about one mile east-northeast of the last mentioned cut on the railroad north of the station, the Cretaceous-Eocene contact is beautifully exposed in the highway as shown in Plate II. The ledge that shows in the midst of the scenery and causes a sharp descent in the road is caused by the incursion of the Eocene sea. Hence in the greater part of this layer, rolled fragments of *Exogyra*, *Belemnites*, *Nucula percrassa* and many silicious pebbles abound, while at its upper surface and above, *Cucullæa saffordi*, *Enclimatoceras ulrichi*, *Venericardia alticostata* var. and other Midway species occur.

One of the most interesting localities in this region is that designated as Palmer's mill (see frontispiece of this work) in Bull. 43, U. S. Geol. Surv., pp. 67, 73. It is on the Camden road about 5 miles west of Snow Hill. Smith says (p. 67) that in this vicinity "we have the lowermost of the Tertiary beds in direct contact with the uppermost of the Cretaceous. At this place the beds of the two formations appear to be strictly conformable with each other. Here, also, the lower Tertiary beds have a very striking resemblance in lithological characters to some of the Cretaceous; but the fossils, as Mr. Johnson has shown, leave no room for doubt as to the age of the beds."

By turning to p. 73 *op. cit.* or to p. 31 of the present work it will be seen that the strata shown in our frontispiece (Pl. I) are regarded by Smith and Johnson as Cretaceous. By diligent hammering for half a day the writer was able to collect from these beds, *Enclimatoceras ulrichi*, *Venericardia planicosta* (typical), *Calyptrophorus velatus*, *Keilostoma mediavia*, *Meretrix*, *Turritella mortoni*, *Voluta lyroidea*, *Cucullæa saffordi*, *Modiola saffordi* and many fragments, none of which showed a trace of Cretaceous characters. These beds are numbered 21 in the section given on p. 31, and as has been remarked before, they occur in the railroad cut just to the north of the Snow Hill. We therefore conclude that they are at the base some 40 feet above the Cretaceous–Eocene contact. We find no well preserved fossils in bed 20, p. 31, but we have no doubt that had they been obtained they would be Eocene and not Cretaceous, Johnson's statement to the contrary notwithstanding; for they range from 50 to 100 feet above

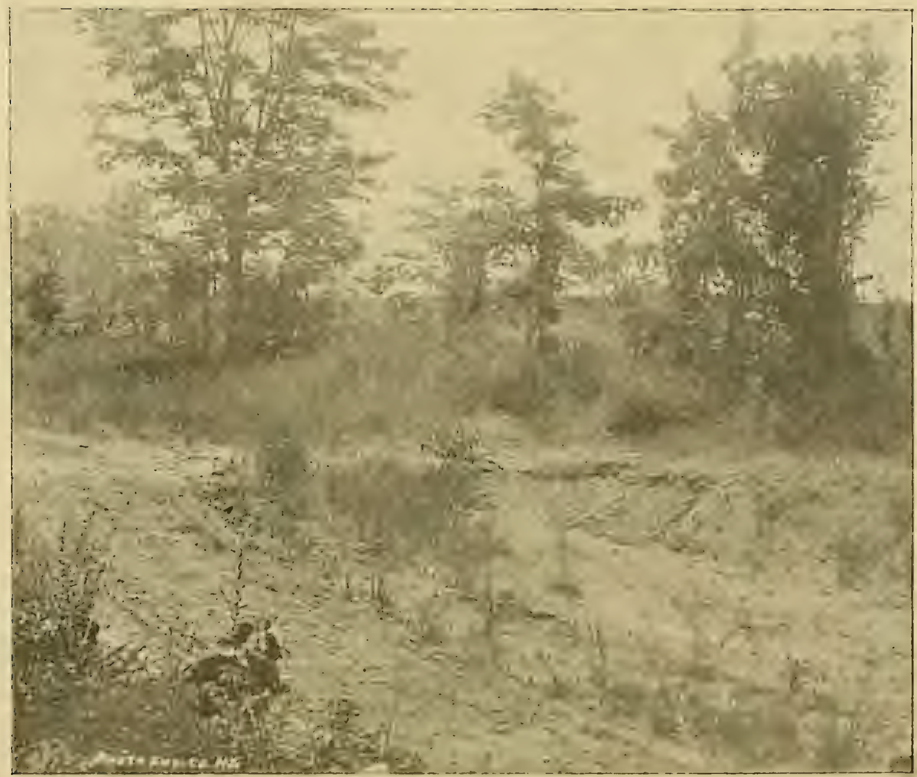


PLATE II.—Cretaceous–Eocene Contact, 3½ Mi. N. E. of Snow Hill.

the Cretaceous–Eocene contact. Inasmuch as Smith and Johnson put the contact line about 100 feet up in the Eocene, namely, at the base of bed 19, it is not strange that "the two formations appear to be strictly conformable" and that their lithological resemblances are "striking."

Leaving Palmer's mill and going to the south and southwest a mile or two, one observes that beds 17, 18 and 19, p. 31, are all fossiliferous; bed 19 is the so-called Turritella limestone of this region while 17 has been known as the Nautilus and Enclimatoceras rock. It is however bed 18 from which the greatest variety of fossils are obtained. From this zone we procured at Cole's place 1 mile west of Palmer's mill, *Ostrea crenulimarginata*, *Cucullæa saffordi* var., *Venericardia planicosta* typical and var. *smithii*, *Mesalia pumila*, *Calyptrophorus velatus* and many other imperfect specimens.

The most famous locality however for lower Midway fossils yet discovered is on the plantation of W. W. McConnico about 1½ miles southwest of Palmer's mill. We found this plantation in charge of Mr. Stonewall McConnico who very generously gave us the privilege of selecting such fossils from his cabinet as were of most interest to us and then escorted us to the best collecting grounds on the place. Here in a cornfield we obtained *Venericardia planicosta* typical, and var. *smithii*, *Ostrea crenulimarginata*, *O. pulaskensis*, *Crassatella gabbi*, and *C. ?*, *Cucullæa saffordi*, and *C. ?*. *Pectunculus*, *Plicatula?*, *Cerithium claytonense*, *Keilostoma mediavia*, *Turritella mortoni*, *T. alabamiensis*, *Voluta lyroidea*, *Pseudoliva scalina*, *Strepsidura? mediavia*, *Fissurella mediavia*, *Calyptrophorus velatus* var. *compressus*, *Mesalia pumila*, *Natica* and other doubtful specimens.

By the roadside 1 mile south of Palmer's mill we obtained in a cornfield, *Ostrea crenulimarginata*, *Venericardia* var. *smithii*, *Mesalia pumila*, *Strepsidura? mediavia*, *Cerithium claytonense*.

Allenton and Oak Hill and vicinity.—Immediately after crossing Pine Barren creek on the road from Snow Hill to Allenton one ascends a steep slope caused by the presence of the Turritella limestone and its adjacent beds. Besides *Turritellæ*, mostly of the type styled *alabamiensis*, the different varieties of *Venericardia planicosta* are met, along with *Ostrea crenulimarginata*, *Cucullæa saffordi*, *Meretrix*, *et al.*

At Josh Hunter's, about half way from Snow Hill to Allenton, the "Enclimatoceras" and "Turritella rocks" are well displayed, the latter teeming with its typical genus. It contains moreover, *Ostrea crenulimarginata*, *Venericardia planicosta* and var. *smithii*, *Cucullæa saffordi*, *Meretrix*, *Pectunculus*. *Calyptrophorus velatus* var., *Natica*, *etc.* The Enclimatoceras rock affords besides its typical species, *Cucullæa saffordi*, *Venericardia*, *Yoldia eborea* and corals.

Half way from Josh Hunter's to Allenton we halted and picked out of the rocks at the roadside, *Pholadomya* sp. and *Cucullæa saffordi*.

On the hill-slope 1 mile north of Allenton we encountered the Graveyard Hill fauna and collected in a cornfield, *Enclimatoceras ulrichi*, *Crassatella sepulcollis*, *Cucullæa macrodonta*, *Venericardia alticostata*, *Nucula mediavia*, *Turritella alabamiensis*, *Pleurotoma adeona*, *Dentalium* and corals.

In the highway near the dwelling place of Mr. W. W. McConnico we observed traces of what seemed to be this same fauna. The specimens however were fragmentary. Mr. McConnico very kindly guided us to the famous Oak Hill outcrops and assisted in making two or three valuable collections. A few minutes' stay at Dale's branch sufficed to gather the following specimens: *Venericardia alticostata* (Matthews' Landing var.), *Yoldia eborea*, *Cucullæa macrodonta*, *Nucula ovula*, *Pecten alabamensis*, *Cardium nicolletti* var., *Astarte aldrichiana*, *Dentalium*, *Cadulus turgidus*, *Fulgur eocense*, *Fusus tortilis*, *F. mohri*, *Pseudoliva vetusta*, *Turritella mortoni* var. *levicunea*, *Turritella alabamiensis*, *Strepsidura heilprini*, *Exilia pergracilis*, *Calyptrophorus velatus* var., *Pleurotoma persa*, *P. adeona*, *Pyropsis perula*, *Volutilithes rugatus*, *V. quercollis*, *Caricella leana*, *Scaphella showalteri*, *Natica alabamiensis*, *Levifusus trabeatus* var., *L.? dalei*.

The best and most convenient collecting ground in this vicinity is at the roadside 1 mile west of Oak Hill P. O. This is bed 9, see p. 31. The matrix consists of a blackish, grayish and greenish sandy clay about 6 feet thick and rests upon a hard ledge of sandstone,—bed 10. This shows practically the same fauna as that enumerated from Dale's branch, though it is somewhat more prolific. One of our most important discoveries here was a specimen of *Enclimatoceras ulrichi*, fragmentary to be sure but showing well the form of the volutious and the septa, and coming from the very upper limit of bed 9. Some of the other forms observed here are as follows: *Pecten alabamensis*, *Verticordia*, *Cucullæa macrodonta*, *Yoldia eborea*, *Leda quercollis*, *Venericardia alticostata* (Matthews' Landing var.), *Cadulus turgidus*, *Cylichna meyeri*, *Scaphander alabamensis*, *Pleurotoma adeona*, *P. persa*, *P. mediavia*, *Pleurotomella whitfieldi*, *Levifusus suteri*, *F. mohri*, *F. quercollis*, *F. tortilis*, *F. meyeri*, *Murex matthewsensis*, *M. morulus*, *Fulguroficus juvenis*, *Pyropsis perula*, *Exilia pergracilis*, *Strepsidura heilprini*, *Turritella alabamiensis*, *Trochus alabamensis*, *Olivella mediavia*, *Volutilithes rugatus*, *V. limopsis*, *Pseudoliva unicarinata*, *P. vetusta* var., *Solarium perscelidium*, *S. alabamense*, *N. reversa*.

One-half mile west of Graveyard Hill (between Oak Hill and Palmer's mill) the following species were collected from beds evidently of the same horizon as those seen 1 mile north of Allenton: *Enclimatoceras ulrichi*, *Ostrea pulaskensis*, *Nucula mediavia*, *Cucullæa macrodonta*, *Venericardia alticostata*, *Yoldia eborea*, *Crassatella sepulcollis*, *Pectunculus*, *Tornatellæa quercollis*, *Pleurotoma adeona*, *Olivella mediavia*, *Turritella alabamiensis*, *Mesalia alabamiensis*, *Pyrula juvenis*, *Pseudoliva scalina*, *Volutilithes rugatus*, *Natica perspecta*, *Calyptrophorus velatus* var.

The "hard ledge" around the upper portion of Graveyard hill contains numerous fragmentary specimens of a *Meretrix*, *Venericardia alticostata*, and a Cephalopod probably *E. ulrichi*.

Troy and vicinity.—Our stay in this region was unfortunately very brief and we were unable to obtain any satisfactory sections, exposures or collections. In the road, however, about 3 miles east-southeast of Troy imperfect specimens were obtained of what appeared to be *Ostrea crenulimarginata* and *Venericardia alticostata* in a red iron clay-stone.

Clayton and vicinity.—There are several important exposures in the vicinity of Clayton, Barbour Co., that furnish a well characterized fauna. On the railroad northeast of here about 1 mile a deep cut is seen exposing blue clays above and ledges of light sandy limestone below with many specimens of *Ostrea crenulimarginata*. One-third mile farther on, another cut is found exposing the following beds:—

a. Dark clay, unfossiliferous as far as observed but containing perhaps some tripoli. Seen in the upper part of cut, - - - -	20 feet.
b. Lignitic clay; dark, - - - -	3 feet.
c. Light yellowish, impure, arenaceous limestone, with innumerable casts and impressions of *Turritellæ* and other forms. According to Dr. Gill a specimen of this contains over 45 per cent. of quartz sand, with a little mica and limonite,	4-8 feet.
d. Yellow sand. This bed extends from the level of the R. R. track up to the hard limestone ledge (*c*). Barren, - - - -	8 feet.
e. Lignitic clay, more or less micaceous and pebbly, separated from the bed below (*f*) by a line of nonconformability. This is seen only at the east end of the cut, - - -	2 feet.

f. Blue micaceous, clayey sand. Seen below the R. R. track near the east end of the cut. Nonfossiliferous, - - - - - 10 feet.

g. Bluish and mottled clay, with hard layers of sand. Nonfossiliferous, - - - - - 10 feet.

h. Bluish clayey sand mottled with yellow and red, very micaceous, and as far as observed, nonfossiliferous. This and *g* are seen in a ravine just east of the cut, - - - - - 30 feet.

The limestone of bed *c* is by no means persistent; towards the eastern end of the bluff it passes into yellow sand and all trace of fossil remains are effaced.

By diligent hammering in these calcareous beds we were able to obtain a number of very nice molluscan impressions, and upon returning to the University, by means of gutta-percha moulds the exact form, size and surface markings of many new as well as old species were ascertained. Perhaps the best find at this locality was casts belonging to *Perna*, a new genus in our Eocene deposits, though not rare in the basal Eocene of Europe. The following are some of the more important species of this locality: *Ostrea crenulimarginata*, *Perna cornelliana*, *Crassatella* sp.?, *Venericardia planicosta* and var., *Lucina claytonia*, *Voluta florencis*, *Calyptrophorus velatus* var., *Pseudoliva scalina*, *Turritella humerosa*, *Turritella* sp., *Cerithium mediaviæ*, *C. globoleve*, *Mesalia watsonensis*, *Keilostoma mediavia*, *Natica* near *onusta*.

In the little ravine just beyond this cut we observed many large fragments of boulders of a peculiar red, clay ironstone containing some sand and a great number of broken quartz crystals. Impressions of fossils are quite common in these boulders. We noted particularly *Turritella humerosa*, *Mesalia watsonensis*, *Venericardia* var. *smithii*, *Ostrea*, *Tellina*, *et al.* They show that although the rocks are not in place they represent a horizon practically that of the limestone described above.

Through the kindness of Dr. Smart of Clayton, Mr. Hubbard was enabled to visit by carriage several important localities more or less distant from the village. From Lee's, near Harrison's mill, 3 miles southwest of Clayton, a large and beautiful series of *Ostrea crenulimarginata* was obtained.

Another locality, 1 mile south of Clayton, near the railroad on Dr. Smart's land furnished *O. crenulimarginata* (fine), *Venericardia planicosta*, *Calyptrophorus velatus*, *Trochita*, *Cardium*, *etc;* the oyster however is the characteristic or predominant species.

Georgia.

Ft. Gaines and vicinity.—The lowest Midway beds seen on the Chattahoochee, lying but a few feet above well defined Cretaceous deposits, consist of light gray or yellowish impure limestone. This is frequently eroded in a peculiar rough and irregular manner. Silicious pebbles and flakes of mica are common ingredients of the limestone. Fossils are of frequent occurrence in this formation, but here as at Clayton, they consist only of impressions, moulds and casts. They are remarkable for their resemblance to or rather identity with those of the basal limestone east of Middleton, Tenn., (p. 21) referred to as the Turritella rock of northeast Mississippi. Among other forms may be mentioned *Venericardia planicosta*, *V. alticostata*, *Corbula subcompressa*, *Cucullæa* probably *saffordi*, *O. crenulimarginata* (young), *Voluta florencis*, *Strepsidura mediavia*, *Mazzalina impressa* var. *orientalis*, *Turritella tennesseensis*, *T. pumila*, *Calyptrophorus velatus* var.

A little higher up, *i. e.*, downstream, other important species are seen, such as *Voluta lyroidea*, *Meretrix ripleyana*, *Leda saffordana*, *Martesia dalliana*, *Ostrea crenulimarginata* and *O. pulaskensis*.

A bluish, more or less indurated, micaceous, sandy layer outcropping not far above the mouth of Sandy creek furnishes nearly all the species just mentioned as well as *Turritella humerosa* and extremely large specimens of *T. mortoni*.

By far the most interesting Midway locality seen about Ft. Gaines is at the landing. The Midway beds are confined to a few feet of whitish crumbling limestone at the base of the bluff and are overlayed unconformably by Lignitic dark clays. As in nearly all Midway limestone deposits, the shelly matter of the specimens inclosed is entirely removed, and hence one is left to work out the details of the various specific forms by means of gutta-percha moulds. The number of new species is noteworthy; the number of old ones is scarcely sufficient to permit of accurately correlating this bed with anything heretofore described; but partially on faunal and partially on stratigraphic grounds, we have referred it to the upper Midway.

Among the many specimens obtained here the following are the most readily obtained and best preserved: *Astarte subpontis*, *Gastrochæna gainesensis*, *G. cimitariopsis*, *Lithodomus gainesensis*, *Modiola subpontis*, *Ostrea crenulimarginata*, *Chama gainesensis*, *Venericardia* sp., *Arca* sp., *Mitra subpontis*, *Volutilithes* (of Midway rough aspect) sp.?, *Turritella mortoni* var. *levicunea*, *Fusus tortilis*, *Natica mediavia*, *Cerithium gainesensis*. Moreover, a large *Cerithium* fragment showing two internal lirations on the base of the penultimate whorl and some indications of sculpturing, suggests relationship with *C. claytonense*. Casts of *Siliquaria*, *Arca*, *Cypræa*, *Pectunculus* and crab remains were also found here.

ADDITIONAL REMARKS AND DEDUCTIONS.

Nonconformability.

The marked paleontological break between the Cretaceous and basal Eocene as represented in the Mississippi basin, has, we believe, strongly impressed itself upon all our Neozoic paleontologists. That this break should be so complete while no authentical accounts of stratigraphic nonconformity were recorded, seemed indeed anomalous. This deficient record is doubtless chiefly due to three causes: 1st, lack of paleontological knowledge on the part of field geologists, causing them to be unable to locate within a fair approximation of accuracy the dividing line between different formations of similar lithological characters; 2d, paucity of contact exposures; 3d, limited extent of such exposures.

Concerning the particular contact line in question only a few notes will be given, all taken from the writer's personal observation.

Texas.—On the Brazos river there is a bed (see p. 14) one foot thick of doubtful age that divides the Midway from the Cretaceous. The exposure is too limited to determine definitely whether there is discordance or not in the stratification of the respective formations.

Arkansas.—A few years ago the writer* called attention to the fact that in this State the Cretaceous system is overlayed by Midway Eocene deposits to the northeast of Rockport while to the southwest the Cretaceous comes to the surface in a large ⊳-shaped expanse. This shows, however construed or explained, that the two systems are nonconformable to each other.

Tennessee.—Unfortunately we did not find any actual Cretaceous–Eocene contacts in this State, but so far as can be judged from Dr. Safford's specimens and notes the stratigraphy along this line is precisely the same as in Mississippi.

Mississippi.—At Chalybeate the spring below the Academy issues from beneath an Eocene limestone layer resting directly upon typical upper Cretaceous marl (see p. 22). Here the foliage is so dense that it was not possible to say whether there was stratigraphic nonconformity or not though the break lithologically and paleontologically was complete.

In a ravine on Mr. Bobo's land, 1½ miles N. N. E. of the spring, the basal bed of Eocene limestone was cemented to an underlying limestone of the same physical aspect bearing *Exogyræ* and *Baculites*. The contact line was marked by a row of large quartz pebbles.

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* Ann'l Rep't Geol. Surv. Ark., 1892, vol. ii; publ. 1894, p. 185.

Near the forks of the road ½ mile south of Ripley, near a spring the following section was obtained:—

a. Red sand.	
b. Limestone,	5 feet.
c. Green sand, pebbles, sharks' teeth,	1 foot.
d. Blue and yellow clay with fine fragments of *T. mortoni* (young), *C. planicosta*, *etc.*,	2 feet.
e. Blue clay with fragments of *Scaphites*,	1 foot.

No distinct break was here seen.

Alabama.—In the vicinity of Prairie Bluff the uppermost bed of undisturbed Cretaceous material is generally a bed of hard bluish micaceous clay averaging perhaps 7 feet thick. The upper surface of this bed is wonderfully irregular and has plainly been subjected to strong eroding currents. Above, comes a layer of coarse granular sandstone with pebbles, sharks' teeth, fragments of *Baculites*, *Exogyræ*, *etc.* This bed grades upwards (8-12 feet) into a bluish clay limestone with *Cucullæa*, *Ostrea pulaskensis*, *Enclimatoceras* and several other small stunted Eocene species. These various beds may be seen at the best advantage on Shell creek 1½ miles S. W. of Prairie Bluff (see p. 28), or in the fields to the right of the road as one passes from the Bluff northward from ½ to 2 miles. Immediately at the Bluff the contact line is a few feet below the level of the cotton storage shed.

Since in Smith and Johnson's sections of this bluff they put the Cretaceous–Eocene line far up in the Eocene, the fact that no nonconformity was observed and recorded is readily explainable. In the same way the lack of nonconformity in the "Pine Barren" section has already been accounted for (see p. 33).

By going northward from Snow Hill along the R. R. track one can easily determine the Cretaceous–Eocene contact line with a fair degree of accuracy, say within five feet, but at the time of our visit to that vicinity the exact line and hence the question of nonconformability could not be satisfactorily determined. By going out the highway from Snow Hill, say about 3½ miles, towards Carlowville the contact line is very evident (see pl. II). The lithological as well as the faunal break is complete. The amount of rolled and polished stones and fragments of Cretaceous shells to be found along this line is sufficient evidence of a most complete stratigraphic break.

Georgia.—Here too the lithological and paleontological break is complete. The exposures were not sufficiently extensive along the contact line to enable us to prove discordance of stratification though we doubt not that the same exists.

With only the above facts in mind we are inclined to think that there was a considerable time interval between the close of Cretaceous deposition and the beginning of Eocene deposition in the Mississippi basin, and that wherever good contact exposures are found, there may be found on careful study, ample evidence of nonconformability.

Correlations made.

The following tables show in a general way the writer's ideas regarding the probable stratigraphic relationship of the various Midway beds heretofore described. Particular attention should be given to the fact that it is the medial portion of the stage only, that has generally been referred to by Alabama geologists as Midway. The lower beds were usually referred to the Cretaceous. Langdon however met the latter on the Chattahoochee river and correctly referred them to the Midway Eocene, though unfortunately he supposed them to be the outgrowth of the "Turritella rock" of central Alabama.

Again, the "Turritella rock" of Mississippi and Alabama are probably 100 feet apart stratigraphically and hence when beds are so designated, it should be stated what locality is referred to; better still, such names should be abandoned. So far as now appears there is a general similarity between the fossils of this stage and those of the basal Eocene of Europe, yet specific identities are rare. There is however a much closer affinity between our fauna and that of the so-called Cretaceous (really Eocene) of Maria Farinha, eastern Brazil.* No one, at all familiar with our Midway fauna can fail to see the close affinities or perhaps identity with our species of *Harpa* [*Pseudoliva*] *dechordata* White, *Calyptrophorus chelonitis* White, *Fasciolaria?* [*Mazzalina*] *acutispira* White, *Turritella sylviana* Hartt, *Nautilus* [*Enclimatoceras?*] *sowerbyanus* White *non* d'Orb., *Gryphæa trachyoptera* White, *Cucullæa hartii* Rathbun, *Cardita morganiana* Rathbun, *C. wilmothii* Rathbun, *et al.*

Dr. White seems to have followed the generally accepted views of the field workers in Brazil and called the fossiliferous beds of various horizons Cretaceous. Long ago the writer suggested to Mr. Stanton of the U. S. Geological Survey that some of the "Cretaceous" material from this river Maria Farinha was to all appearance Midway Eocene. He agreed that it had no traces of Cretaceous features.

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*Contr. Pal. Brazil, C. A. White, 1888, vol. vii, *Archivos do Museu Nacional do Rio de Janeiro.*

CORRELATION TABLE, I.

	Texas.					**Arkansas.**
	Rio Grande.	*Colorado River.*	*Brazos River.*	*Limestone Co.*	*Kaufman Co.*	*Little Rock.*
UPPER.			Bluff near Smiley's. *p. 14.* Black Bluff.	Sands South of Tehuacana.	Wills Point Clays and Sand. *p. 15.*	Tubulostium bed.
MEDIAL.	"Cardita" Bluff. *p. 13.*	Limestone near Webberville. *p. 14.*	½ mile below Cret.–Eoc. Contact. *p. 14.*	Tehuacana and Horn Hill Limestones. *p. 15.*	Rocky Cedar Creek Limestone. *p. 16.*	Enclimatoceras and Turritella Limestones. *p. 17.*
LOWER.			At Eocene–Cretaceous Contact. *p. 14.*	Boulder Clay North of Tehuacana.	Clays West of Rocky Cedar Creek.	

CORRELATION TABLE, II.

Tennessee.		**Miss.**	**Alabama.**				**Ga.**
Crainesville.	*Middleton.*	*Ripley.*	*Tombigbee River*	*Alaba. River.*	*Oak Hill etc.*	*Clayton.*	*Ft. Gaines*
	Porter's Creek.	Black Clay 3 miles N. W. of Ripley	Naheola Marls. *p. 25.* Black Bluff Upper.	Matthews' Landing Clays. *p. 29.*	Marl 1 mile West of Oak Hill P. O. Graveyard Hill. *p. 34.*		?Limestone of Ft. Gaines
Outcrops at Hannah's and Huddleston's. *p. 18.*	Middleton Calcareous Green-specked Clays. *p. 21.*	Venericardia Bed 1½ miles N. W. of Ripley *p. 23.* Blue Mt.	Black Bluff Middle Clays. *p. 25.*	Midway Limestones. *p. 29.*	Enclimatoceras and Tur'tella Limestone S. of Palmer's Mill. *p. 33.*	Oyster Beds 1 mile S. and 3 miles S.W. of Clayton.	Beds near the mouth of Sandy Creek.
Base of Bed *f* at Hannah's. *p. 18.*	Clay and Limestone 2 miles E. of Middleton. *p. 21.*	Ripley Clays and Limestone. *p. 23.*	Black Bluff Lowest Clays.	Beds *b, c, d.* *pp. 28-29.*	Beds 20, 21 and off-set. *p. 31.*	Limestone 1⅓ miles N.E. of Clayton.	Basal Limestone Beds.

Mr. Orville A. Derby, a former Cornellian, now State Geologist of Sao Paulo, in reply to recent inquiries, says:—

"Your letter of Jan. 28th [1896] has interested me very much.

"Some years ago while I was still in the Museum, a German paleontologist (whose name I do not now remember with certainty but I think it was Koken) wrote to the Director in the same sense. I replied to the letter calling attention to the more pronounced Cretaceous character of the Sergipe fauna and suggesting that he discuss this question for which I offered to furnish the material, but I heard nothing further in the matter.

"I believe also that some of the German notices of Dr. White's work referred to the Tertiary aspect of many of the fossils, but as far as I know no proper discussion has been given to the subject.

"The age determination of these faunas on geological grounds is weak and would not stand against decided paleontological evidence. The assumption that the different basins are substantially of the same age is unproven. We had fallen into the habit of calling all the slightly disturbed fossiliferous beds Cretaceous, and the undisturbed nonfossiliferous ones Tertiary, but without definite proof.

"I had expected that the study of the fossils would show a closer relationship between the faunas than it did. That of Maria Farinha can only be connected with that of Sergipe, which as I understand is the most typical Cretaceous, through that of Para. And if this argument fails its reference to the Cretaceous falls to ground."

Variation of faunas.

It seems indeed remarkable that certain very characteristic species of the Midway fauna, throughout Texas, Alabama, Tennessee, Mississippi and western Alabama, should die out or be replaced by others between central Alabama and Chattahoochee river. There are, to be sure, a sufficient number of connecting links in the lower and middle portions of the stage to serve well for correlation purposes. In fact the fauna from the Muddy Creek limestone, Tenn., and that of the basal Eocene beds on the Chattahoochee are remarkably alike. There are, too, the characteristic central Midway species of *Ostræ*, *Turritellæ*, *Venericardiæ*, *etc.*, on the Chattahoochee. But the paucity of *Volutilithes*, *Crassatella*, *Cucullæa*, *Pseudoliva*, *et al.*, is noticeable. The upper Midway bed at the base of the bluff at Ft. Gaines bears a fauna almost wholly new. Its correlation with upper Midway faunas farther west on the Alabama river and near Oak Hill is not proven. We are led to believe that it differs so widely from the last mentioned faunas because of differences in environment;

instead of living on a sea bottom of black muddy ooze, it flourished in a clear coralline sea.

The absence of *Enclimatoceras* in the Chattahoochee section does not mean the absence there of any one particular bed; we have already shown how great is the vertical range of this genus. Much less does its absence mean that all the beds that do not contain it are the out-growth of the so-called "Turritella rock" of central Alabama.

* * *

PART II. PALEONTOLOGY.

DESCRIPTION OF THE MOLLUSCAN REMAINS OF THE MIDWAY STAGE.

Pelecypoda.

OSTREA.

Ostrea crenulimarginata, { Pl. 1, fig. 1, a, Pl. 2, fig. 1, a, Pl. 3, fig. 1.

Syn. *O. crenulimarginata* Gabb, Jr. Phila. Ac. Nat. Sci., 2d ser., vol. 4, 1860, p. 398, pl. 68, figs. 40, 41.
O. denticulifera Gabb, *non* Con., *Ibid.*, p. 398.
O. denticulifera Safford, *non* Con., Geol. of Tenn., 1869, p. 419.
O. præ-compressirostra Harris, Ark. Geol. Surv., vol. 2, 1892, publ. in June, 1894, p. 39.
O. compressirostra Langdon, *non* Say., Geol. Surv. Ala., 1894, p. 413.
O. tumidula Aldrich, Geol. Surv. Ala., Aug., 1894, p. 242, pl. 14, figs. 1 & 2, pl. xv, figs. 1 & 2.

Gabb's original description.—"Subtriangular, sometimes elongated, oval; attached; portion of the outside of the shell not attached is very squamose; hinge about an equilateral triangle, central groove of the hinge deep; internal margin strongly crenate, muscular impression large; upper valve?.

"*Dimensions.*—Length 2.2 in., greatest width about 2 in.

"*Locality.*—Found in a marl bank, two miles east of Middleton, Tenn. Rather common and associated with *O. denticufera* Con."

The type specimens of this species were very kindly lent me by Dr. Safford. The figured specimen, fig. 40, *op cit.*, was attached during growth to a nearly flat fragment of wood and hence does not show well the radiating plications, yet they are indicated in one place. One of the specimens grew on a *Venericardia planicosta*, and shows ribbing. Gabb for some unknown reason selected out the most of the left valves in Safford's collection and named them *crenulimarginata*, while the right valves he styles *denticulifera*; all these I have before me. They are small and immature. The characters of the species are well shown on pl. 1, fig. 1, a, and pl. 2, fig. 1, a, after Aldrich. The lesser valves when young present a peculiar pyri-circular outline and are smooth, thin and convex. Such specimens are common 1 mile north of Midway.

Fig. 40 of Gabb's work is, according to Dr. Safford's notes, from a "bank near, or on the old stage road 2 miles south of Middleton." Others are from the R. R. cut 2 miles east of Middleton, and still others from the limestone on Muddy creek east of Middleton.

Localities.—TEXAS: Horn Hill and Tehuacana, Limestone Co.; Brazos river, 3 miles above mouth of Pond creek.
ARKANSAS: 1⅝ mi. N. of Bradford, St. L., I. M. & S. R. R.; Johnson's well, Capitol Hill, Little Rock; Sect. 15, 1 S., 14 W.; N. W. of N. E. ¼, Sect. 8, 1 S., 13 W.; Sect. 18, 2 S., 15 W.; Cabot, Lonoke Co.
TENNESSEE: East and south of Middleton 2 miles; McDonald's mill 4 miles S. W. of Middlton.
ALABAMA: 1 mi. N. of Midway; 1 mi. W., 1½ mi. S. W. and 1 mi. S. of Palmer's mill; R. R. cut at Snow Hill; R. R. cut ½ mi., and 2 mi. N. of Snow Hill; 3 mi. N. E. of Snow Hill; Pine Barren creek 2 mi. S. of Snow Hill; Graveyard Hill, hard ledge; Josh Hunter's; ? 3 mi. E. S. E. of Troy; Dr. Smart's, 1 mi. S. or S. W. of Clayton, near R. R.; Lee's, near Harrison's mill, 3 mi. S. W. of Clayton; 1 & 1⅓ mi. N. E. of Clayton.
GEORGIA: Chattahoochee river, near mouth of Sandy creek, and ? at base of bluff at Ft. Gaines.

Type.—Collection of Jas. M. Safford, Vanderbilt Univ., Nashville, Tenn.

Ostrea pulaskensis, Pl. 1, figs. 2, a, b, c; 3, a.

Syn. *Gryphæa vomer* Saff., Geol. of Tenn., 1869, p. 419.
"*Gryphæa pitcheri* Mort.?" White, Proc. U. S. Nat. Mus., vol. iv, 1881, p. 137.
O. pulaskensis Har., Ark. Geol. Surv., vol. ii, 1892, p. 40, pl. 1, figs. 3, a, b, c, d.
Gryphæa vomer Langdon, Geol. Sur. Ala., 1894, p. 416.

Harris' original description.—"Outline of the larger valve rightangle-triangular; a carination from the umbo to the posterior basal margin forming the hypothenuse, the basal margin the base, and the shorter margin from umbo to base the perpendicular with proportional lengths of 8, 7 and 5 respectively; beak generally very incurving; carination often very pronounced; between it and the margin of the valve are one or two more or less distinct sulci; surface comparatively smooth, though possessing a few slight concentric undulations which, curving upwards in the middle of the valve, form a very shallow sulcus extending from beak to base; muscular impression not distinctly marked; lesser valve thin, flat, circular; marked exteriorly by lines of growth; smooth within, with an oval muscular impression which is submarginally located.

"This description, and the figures referred to, show the most *Gryphœa*-like phase of this species. Other forms are less distinctly sulcate and carinate."

Peculiar specimens, presumably of this species, occur 1 mile north of Midway. They seem to have adhered most readily by the posterior portion of the valve so that they became distorted. In some instances the left valve appears like a half valve, *i. e.*, the valve is split from the apex to the base and glued on some surface by the straight edge; or the basal anterior margin is greatly produced as in *Gryphœa trachyoptera* White.

Localities.—TEXAS: Brazos river, Falls Co., about 1 mi. above the Milam Co. line or ½ mile below the Cretaceous–Tertiary contact on this river.

ARKANSAS: N. W., S. E. ¼, Sect. 8, 1 S, 13 W.; Sect. 15, 1 S., 14 W.; Sect. 2, 3 S., 16 W.; Sect. 36, 2 S., 16 W.

TENNESSEE: Hannah's, 1¾ mi. N. of Crainesville, bed *b;* Huddleston's; McDonald's mill, 4 mi. S. W. of Middleton.

MISSISSIPPI: ½ mi. S. of Ripley; 2 mi. E. of Ripley (?).

ALABAMA: Road ¾ mi. W. of Prairie Bluff; 1 mi. N. of P. B.; 1 mi. N. of Matthews' Landing (varietal form); 1½ mi. S. W. of Palmer's mill (var.); ½ mi. W. of Graveyard hill.

GEORGIA: Chattahoochee river, near mouth of Sandy creek.

Types.—U. S. National Museum.

PLICATULA.

Plicatula?, Pl. 2, fig. 2, a.

This strange form has been figured simply to call attention to its existence so that others may seek more perfect specimens and determine its true place generically and specifically.

From ½ mile E. of S. McConnico's, near Palmer's mill, from bed 18 of section on p. 31.

PECTEN.

Pecten alabamensis, Pl. 2, fig. 3.

Syn. *P.* (*Pleuronectia*) *alabamensis* Ald., Geol. Surv. Ala., Bull. No. 1, p. 40, pl. 4, fig. 8.
P. (*Amussium*) *alabamensis* De Greg., Mon. Faun. Eoc. Ala., 1890, p. 183, pl. 21, fig. 26.
P. alabamensis Har., Geol. Surv. Ark., vol. ii of Rep't for 1892, p. 41.

Aldrich's original description.—"Shell small, suborbicular; upper valve covered with equidistant concentric lines which run over upon the anterior ear; a few raised radial lines upon the center and anterior side; ears small; right valve nearly smooth; within both valves eight raised prominent rounded ribs, becoming obsolete as they approach the beak.

"*Locality.*—Matthews' Landing, Ala.

"Seems to unite *Pleuronectia* and *Pecten*. One specimen shows concentric striæ and ribs in the younger part of shell, these becoming obsolete toward the ventral margin."

Localities.—ARKANSAS: Marshall's well, Little Rock. Tubulostium bed.
ALABAMA: Naheola; Matthews' Landing; Dale's Branch.

Type.—Collection of T. H. Aldrich.

AVICULA.

Avicula sp., Pl. 2, figs. 4, a.

We have obtained from the Midway stage but a few imperfect casts of this genus, all from near the mouth of Sandy creek on the Georgia side of the Chattahooche river. They represent but one species, and are too imperfect to merit specific description.

Specimens figured.—Paleontological Museum, Cornell Univ.

PERNA.

Perna cornelliana n. sp., Pl. 3, figs. 2, 3.

Specific characterization.—General form as indicated by fig. 2; apical cartilage pits short and much wider than the interspaces, the anterior two bounded below by an oblique tooth-like elevation; posteriorly, pits and interspaces becoming of more nearly the same width, while the pits are somewhat contracted above; muscular impressions numerous about the anterior apical portion of the body cavity, shown in the figure as small elevations about the beak of this internal cast; shell rather thin.

This species resembles *P. bazini* Desh. in general, but has different umbonal and ligamental characters and is more oblique. Deshayes species is from the *Sables inférieurs* of the Paris basin.

We have felt much hesitation in naming specifically specimens so imperfectly preserved. But the peculiar hinge characters and the interest attached to the discovery of this genus in our Eocene deposits render it doubly advisable to have a name whereby the species may be conveniently referred to.

Locality.—Railroad cut, 1⅓ miles N. E. of Clayton, Barbour Co., Ala.

Type.—Paleontological Museum, Cornell Univ.

MODIOLA.

Modiola subpontis n. sp., Pl. 3, figs. 6, a.

Specific characterization.—General form as shown by the figure —twice natural size; very gibbous especially about the umbones which are incurving and resemble those of *Lithodomus gainesensis;* surface marked by strong, bifurcating, radiating lines like those of many members of this genus; near the umbones the lines are less distinct. This shell is found in the burrows or within the shells of *Gastrochæna* or *Lithodomus.* The one figured was broken out of an *L. gainesensis* a part of which is shown in the figure. A portion of the exterior of this individual is shown in fig. 6, a.

Locality.—Uppermost layer of the Midway limestone as exposed at Ft. Gaines, Ga. Rare.

Type.—Paleontological Museum, Cornell Univ.

Modiola saffordi, Pl. 3, fig. 4, 5.

Syn. *M. saffordi* Gabb, Jr. Ac. Nat. Sci., vol. iv, 1860, p. 395, pl. 68, fig. 30.
M. saffordi Saff., Geol. Tenn., 1869, p. 419.

Gabb's original description.—"Gibbous, widened posteriorly; beaks small, anterior; umbones very large; umbonal ridge prominent, rounded, with a rounded furrow anterior to it; cardinal margin nearly straight, posterior margin rounded, basal sinuous; surface marked by regular radiating ribs, except a small space between the umbonal ridge and the beak, leaving a little more than one-third of the basal portion plain, or only marked by lines of growth.

"*Dimensions.*—Length, .3 in., width, .6 in., greatest height of valve, .2 in.

"*Locality.*—From the marls and alternating limestone of the Ripley Group, Hardeman Co., Tenn."

Fig. 4 is from bed *b* at Hannah's, Hardeman Co., Tenn. Fig. 5 from Texas, is probably of the same species.

Type.—Not found in the material sent by Dr. Safford. Lost?

LITHODOMUS.

Lithodomus gainesensis n. sp., Pl. 3, figs. 7, a.

Specific characterization.—General form as shown by the figures; cylindrical; half the size indicated; umbones anterior, very incurving; no teeth; shell thin, marked exteriorly generally by a few concentric low undulations; one specimen shows three or four radiating lines posteriorly; valves apparently entirely closed; no radiating lines seen near the anterior. One specimen was collected which is nearly twice the ordinary size.

Locality.—Uppermost Midway Eocene limestone exposed at Ft. Gaines, Ga. Very common.

Type.—Paleontological Museum, Cornell Univ.

ARCA.

Arca sp., Pl. 3, figs. 8, 9, a.

This little *Arca* is quite common in the uppermost layer of the Midway limestone at Ft. Gaines. It is characterized by rather strong concentric folds, which become tuberculate or spinose where crossed by radii; the latter comparatively few in number and strong on the anterior slope; anterior half of the face of the valve with fine radii; posterior coarser and becoming very coarse and spinose at the umbonal angle; posterior to this, both concentric and radiating sculpturing, well defined. Specimens of somewhat larger size are found near the base of the Midway on the Chattahoochee not far above the mouth of Sandy creek. Another large specimen presumably of this species, was found in a cotton field 1 mile north of Midway. It has a decidedly *Arca mississippiensis*-like aspect. It is about ¾ of an inch in length. It seems unwise to name this species until its relations with the other Eocene *Arcæ* can be more fully investigated. It has the aspect of "*Navicula aspera*" Con. or of *Arca lyelli* of England.

CUCULLÆA.

Cucullæa macrodonta, Pl. 3, figs. 10, a.

Syn. *C. macrodonta* Whitf., Am. Jr. Conch., vol. i, 1865, p. 267, pl. 27, fig. 17.

Whitfield's original description.—"Shell of medium size, subrhomboidal in outline, broad heart-shaped in profile; hinge line nearly as long as the greatest length of the shell; hinge area broad, corrugated; valves deep; beaks distant, slightly incurved; surface marked by from forty-five to fifty low, radiating ribs, which are finely corrugated by concentric lines; ribs indistinct on the posterior part; a rather deep, narrow sulcus extends from the beak to the posterior basal angle, leaving a prominent umbonal ridge; hinge line with sixteen teeth, the right valve having four at each extremity parallel to it; muscular scars sub-quadrangular, the posterior much the largest; muscular ridges faint or obsolete; pallial line crenulate; inner margin of shell smooth.

"This species is remarkable for the very transverse lateral teeth, a feature not often noticed in fossil species of the genus.

"*Locality.*—Nine miles below Prairie Bluff, Alabama."

When the two valves of this species are found together, the right is somewhat smaller, and shuts into the left along the basal margin. Whitfield apparently had but one valve (right), and hence his description is more applicable to the following species than it is to this. The surface markings of the two valves are shown in our figures; that of the right is constant while that of the left is subject to extreme variations. Some specimens, especially those found along the Tombigbee river, show but three or four ribs of the stronger series on the left valve; others show less pronounced difference in sculpturing between the two valves.

Localities.—TEXAS: Brazos river, near Falls–Milam Co. line; Webberville, Colorado river.
ALABAMA: Tombigbee river, Black Bluff and below as far as Naheola; ? 1 mi. north of Midway; Mathews' Landing; 1 mi. N. of Allenton; 1 mi. W. of Oak Hill; ½ mi. W. of Graveyard hill.

Type.—Hall's collection.

Cucullæa saffordi, Pl. 3, fig. 11; pl. 4, figs. 1, 2.

Syn. *Arca saffordi* Gabb, Jr. Ac. Nat. Sci. Phila., vol. iv, 1860, p. 397, pl. 68, fig. 38, *non* 37 as in text.
Cucullæa macrodonta Har., Geol. Surv. Ark., vol. ii, 1892, p. 41.
C. transversa Ald., Geol. Surv. Ala., 1894, p. 242.

Gabb's original description.—Gibbous, nearly equilateral; beaks small, overhanging the area; umbones broad; area narrow and transversly striate; anterior margin narrower and straighter than the posterior, which is regularly curved; surface marked by obscure radiating and concentric lines; hinge rather broad, curved; teeth large.

"*Dimensions.*—Length .2 in., width .26 in., height of valve .1 in.

"*Locality.*—Hardeman Co., Tenn. Prof. Safford. Also found in the Ripley group of New Jersey."

We have not had access to Gabb's type of this species and presume it is lost, since Dr. Safford did not send it along with Gabb's other types. However, our collection contains a large number of specimens from a similar horizon and some from approximate localities; hence it seems that since Gabb's figure and description correspond very well to casts of our specimens it is safe to use his term for designating them.

When studying over and reporting upon the Arkansas material from this horizon it was noted that "The original description of *C. macrodonta* is more applicable to this form than to those from the typical locality [Matthews' Landing] inasmuch as the latter possess strong irregular ribbing on the left valve, while in the the right the sculpturing corresponds to Whitfield's description and to that of both valves of the specimens from Arkansas," (l. c., p. 41).

Not knowing then that Gabb had given a specific name to this form the writer classed it in with *C. macrodonta* which, with the vast amount of material before him at present he regards as incorrect. The name *saffordi* is here used tentatively in place of older names, *transversa* or *gigantea*, for it seems as though it differs somewhat from those species especially in surface marking and in form. The right valve when of ordinary outline and when well preserved looks like the corresponding valve of *C. macrodonta*, and if there were no left valves among a given number of specimens, it would be quite impossible to know to which of the two species, *saffordi* or *macrodonta*, to refer them.

The two valves of *saffordi* are similarly marked while those of *macrodonta* vary considerably (see figures).

There is much variation in the forms of the specimens here referred to *saffordi*. The most remarkable of which is that figured on pl. 4, fig. 1, which is from the so-called Turritella limestone at Hamburg (Josh Hunter's, between Oak Hill and Allenton).

From the striking similarity of these two species it is quite evident that *macrodonta* is the direct descendant of *saffordi*.

Localities.—TEXAS: ? 18 mi. S. E. of Eagle Pass; 4 mi. N. E. of Kemp, Kaufman Co.
ARKANSAS: Olsen's switch, Pulaski Co.; Johnson's well, Little Rock.
TENNESSEE: Hannah's, Huddleston's and Middleton, Hardeman Co.
MISSISSIPPI: Reeve's; limestone ½ mi. S. of Ripley; ½ mi. N. of Ripley; 1 mi. E. of Ripley; Blue Mt., Tippah Co.
ALABAMA: Basal Eocene bed about Prairie Bluff; 1 mi. N. of Midway; 3 mi. N. E. of Snow Hill; Palmer's mill; Cole's place; S. McConnico's, 1½ mi. S. W. of Palmer's mill; Josh Hunter's.

PECTUNCULUS.

Pectunculus, Pl. 4, fig. 3.

The *Pectunculi* of the Midway are not generally well preserved, but as far as can be determined at present they all represent one and the same species. Fragments somewhat eroded, though showing occasional surface markings, indicate a closer affinity with *idoneus* than with *stamineus;* the peculiar strong concentric striæ of the latter are wanting while the fine radiating striæ are present. The Midway species is seemingly the same as that found in the Lignitic at Gregg's Ldg., hence we defer a more minute description of it here.

Localities.—TENNESSEE: 5 mi. S. of Crainesville. (Sp. fig'd.)
ALABAMA: 1½ mi. S. W. of Palmer's mill, Wilcox Co.; between Snow Hill and Allenton, at "Hamburg"; ½ mi. W. of Graveyard hill, Wilcox Co.
GEORGIA: Uppermost layer of the Midway at Ft. Gaines.

NUCULA.

Nucula mediavia n. sp., Pl. 4, fig. 4.

Specific characterization.—Size and general form about as figured; surface showing besides lines of growth, many radiating striæ; lunule large, deeply depressed and sometimes traversed by a faint radiating ridge; within, strongly crenulate at margin; posterior as well as anterior row of teeth well developed, each tooth angulate in the middle; angle formed at the junction of the two rows of teeth about 130 degrees.

The sharp posterior, deeply sunken and sharply defined lunule, great angle formed by the junction of the two rows of teeth and coarsely crenulated margin, serve to distinguish the species.

This is doubtless the "*N. magnifica*" Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 61.

Localities.—ALABAMA: Black Bluff, Tombigbee river; ½ mi. W. of Graveyard hill; 1 mi. N. of Allenton, Station 264, Prairie Cr., Wilcox Co. (U. S. Nat. Mus. coll).

Type.—Paleontological Museum, Cornell Univ.

Nucula ovula, Pl. 4, fig. 5.

Syn. *N. ovula* Lea, Cont. to Geol., 1833, p. 80, pl. 3, fig. 59.

Lea's original description.—"Shell ovate, oblique, inflated, very inequilateral, transversely striate, longitudinally and very minutely ribbed; substance of the shell thin; lunule large, not deeply impressed; beaks pointed, recurved; anterior series of teeth short—posterior series long; fosset nearly direct; cavity of the shell deep; margin very minutely crenulate; nacre pearly.

"Diam. .3, length .4, breadth .5, of an inch."

This was described from the Claiborne sand.

Locality (Midway stage).—ALABAMA: Dale's Branch, Oak Hill.

Type.—Phila. Ac. Nat. Sci.

LEDA.

Leda milamensis, Pl. 4, fig. 8.

Syn. *L. milamensis* Har., Proc. Ac. Nat. Sci. Phila., 1895, p. 47, pl. 1, fig. 4,

Harris' original description.—"General form as figured; surface covered with fine concentric striæ execpt near the anterior margin where it is smooth and polished; diameter from beak to base great, and the shell here much inflated; posterior remarkably narrow and flattened.

"*Locality.*—Smiley's Bluff, Brazos river, two miles above the mouth of Pond Cr.

"*Geological horizon.*—Midway Eocene.

"*Type specimen.*—Texas State Museum."

The figure herewith given is much more typical of the species than the one given in the Phila. Ac. Proc. The anterior half or two-thirds of the shell is very much inflated and is sometimes striate, but in the state of casts, the only markings generally observable are the concentric lines on the flattened posterior.

The new localities we have recorded are: Hannah's, bed *f*, 1¾ miles N. of Crainesville, Hardeman Co., Tenn., and Huddleston's, about the same distance W. of Crainesville.

Leda saffordana n. sp., Pl. 4, fig. 9.

Syn. *L. protexta* Gabb, Jr. Ac. Nat. Sci. Phila., vol. iv, p. 397, pl. 68, fig. 36, (*non L. protexta* Gabb, ibid., p. 303, pl. 48, fig. 23. ? *Leda bella* Con., ibid., p. 295).

Specific characterization.—Size and general form as indicated by the figure (some specimens somewhat more elongate); concentric lines rather prominent centrally but becoming obsolete anteriorly and posteriorly; a slight depression passing from umbo to post basal margin; escutcheon bordered by a well defined ridge and traversed medially by a fainter secondary ridge.

Localities.—TENNESSEE: Near the old stage road, about two miles S. of Middleton, Hardeman Co.
ALABAMA: ½ mi. N. of Snow Hill.
GEORGIA: Near base of Eocene on Chattahoochee river.

The specimens described by Gabb were kindly lent the writer by Dr. Safford. They certainly are not the *L. protexta* Gabb, p. 303, as referred to above; hence the need of a new name and *L. saffordana* has accordingly been proposed. The large, imperfect specimen Gabb refers to, p. 397, is quite probably a different species from the smaller forms.

Type.—Collection of Jas. M. Safford, Nashville, Tenn.

Leda elongatoidea var.?, Pl. 4, fig. 10.

A single valve of a marked variety of a species quite common at Wood's Bluff, Ala., was found at Matthews' Landing. Both this and the Wood's Bluff specimens do not agree entirely with Aldrich's description and figure of *L. elongatoidea* (Bull. Am. Pal. No. 2, p. 17), hence we postpone further discussion until we have ampler material and know to a certainty to what species the name *elongatoidea* has been given.

Leda quercollis n. sp., Pl. 4, fig. 11.

Specific characterization.—Size and general form as indicated in the figure; thick; surface covered throughout with rather strong concentric lines; a faint sinus extending from beak to posterior–basal margin; within, of the same dark brown polished appearance that characterizes the interior of *Yoldia eborea;* anterior row of teeth equaling or surpassing in strength and length those of the posterior.

This species is plainly the ancestor of *L. robusta* Ald. from Wood's Bluff. It differs from his species in having much finer striæ which continue over the whole surface of the valve; in *rabusta* the anterior–dorsal region is nude. *L. quercollis* is about two-thirds the dimensions of *L. robusta*, has a much less angular appearance and a fainter radiating posterior sinus.

Localities.—ALABAMA: 1 mi. W. of Oak Hill P. O., Wilcox Co.; Dale's Branch near Oak Hill P. O., Wilcox Co.

Type.—Paleontological Museum, Cornell Univ.

YOLDIA.

Yoldia kindlei n. sp., Pl. 4, fig. 6.

Specific characterization.—Size and general form as indicated by the figure; surface in casts smooth, but in some well preserved fragments indicating more or less regular lines of growth; somewhat inflated.

Named in honor of a most energetic and promising young paleontologist of this University.

Locality.—TENNESSEE: 1¾ mi. N. of Crainesville, at Hannah's, Hardeman Co. Bed *f*.

Type.—Paleontological Museum, Cornell Univ.

Yoldia eborea, Pl. 4, fig. 7.

Syn. *Leda eborea* Con., Jr. Ac. Nat. Sci. Phila., vol. iv, 1860, p. 295, pl. 47, fig. 26.

Conrad's original description.—"Triangular, equilateral, ventricose, smooth, polished; lunules of equal length and defined by carinated lines; anterior lunule widely elliptical; dorsal margin when the valves are together defined by a slight carina; a slight furrow near the posterior dorsal margin and parallel with it; posterior end acutely rounded and submargin slightly contracted; base regularly rounded.

"Length, ⅝ inch."

There is considerable variation in the size as well as the shape of this species. The Tombigbee river specimens are larger and longer than those from the Alabama river exposures; yet they doubtless all belong to one species. This is one of the typical Midway forms, occurring quite abundantly throughout the same areal extent and horizons with *Enclimatoceras ulrichi*.

Localities.—TEXAS: Brazos river, from Cretaceous–Eocene contact to Falls–Milam Co. line, several localities.
ARKANSAS: Marshall's well, Capitol Hill, Little Rock; Sect. 2, 3 S., 16 W.; Sect. 18, 2 S., 15 W.
TENNESSEE: Hannah's, 1¾ mi. N. E. of Crainesville, Hardeman Co., beds *a* & *f;* Huddleston's, 2 mi. W. of Crainesville.
MISSISSIPPI: Blue Mt., S. of Ripley.
ALABAMA: Black Bluff; Tombigbee river, 4 mi. below Black Bluff; hill just N. of Prairie Bluff; Matthews' Landing; ½ mi. W. of Graveyard hill; 1 mi. W. of Oak Hill; Palmer's mill; Bed *e*, ¾ mi. W. of Prairie Bluff; Dale's branch; "Enclimatoceras limestone" at Hamburg.

VENERICARDIA.

Venericardia alticostata, Pl. 4, fig. 12.

Syn. *V. alticostata* Con., Amer. Jr. Sci., vol. xxiii, 1833, p. 342.
V. perantiqua Con., Amer. Jr. Conch., vol. i, p. 8.
V. perantiqua Whitf., Mon. U. S. G. S., vol. ix, p. 232, pl. 30, figs. 8-10.

Conrad's original description.—"Shell subcordate, convex, with about twenty-two profoundly elevated nodulous ribs, which on the anterior side are laterally carinated. Length, two inches.

"*Locality.*—Claiborne, Ala. *London clay.* Extremely abundant and very variable in outline."

The first forms that presumably merge into this species are very small, about 1 centimeter in length, with 12 ribs, and occur at the very base of the Midway, 3½ mi. N. E. of Snow Hill and in the vicinity of Prairie Bluff. See base of off-set in section (p. 31). Higher up in beds of this off-set a form more nearly typical is encountered. It has from 14 to 18 ribs and is an inch or more in length.

Localities.—TEXAS: 18 mi. S. E. of Eagle Pass.—Dr. White; near Webberville.
ALABAMA: Snow Hill, R. R. cut; 1½ mi. N. of Snow Hill, R. R. cut; 2 mi. N. of Snow Hill, R. R. cut; Palmer's mill.

Closely allied forms occur at the base of the Midway on the

Chattahoochee river, Ga., and in the hard ledge which surrounds Graveyard hill, Wilcox Co., Ala.

In the higher argillaceous deposit of this stage a very sharp (25-30) ribbed variety occurs. See fig. 12 on pl. 4.

Localities.—ALABAMA: Naheola; Matthews' Landing (bed 9); 1 mi. W. of Oak Hill P. O. (bed 9); ½ mi. W. of Graveyard hill (bed 15); 1 mi. N. of Allenton (bed 15).

Venericardia planicosta, Pl. 4, fig. 13.

Syn. *Venericardia* (*planicosta*) Lam., Ann. du Mus., vol. vii, 1806, p. 55; *ibid*, vol. ix, 1807, pl. 31, figs. 10, a, b.
V. planicosta Con., Jr. Ac. Nat. Sci. Phila., vol. vi, 1830, pp. 213, 214 and 215.
Venericardia ascia W. B. & H. D. Rogers, Trans Am. Philos. Soc., 2d ser., vol. v, 1839, p. 374, pl. 29, fig. 2.
Cardita densata Con., Jr. Ac. Nat. Sci. Phila., 2d ser., vol. i, 1848, p. 130, pl. 14, fig. 24.
Cardita planicosta Con., U. S. Mex. B'd'y. Surv., 1857, p. 161, pl. 19, figs. 2, a, b.
Cardita hornii Gabb, Geol. Surv. Cala., Paleont., vol. i, 1864, p. 174, pl. 24, fig. 157.
Venericardia planicosta var. *regia* Con., Am. Jr. Conch., vol. i, 1865, p. 8.
Venericardia mooreana Con., Am. Jr. Conch., vol. iii, 1867, p. 190.
? *Venericardia complexicosta* Ald. and Mr., Jr. Cin. Soc. Nat. Hist., vol. ix, pt. 2, 1887, p. 45, pl. 2, fig. 21, 21a.

Lamarck's original description.—"*Venericardia* (*planicosta*) obliquè cordata, crassissima; costis planis integris; posticis granulatis."

"Knorrs, foss. part. 2, tab. 25, f. 5.

"*β. Eadem minor, suborbiculata.* Vélin, n°. 52, f. 3.

"L. n. Grignon et ailleurs. C'est une très belle espèce dont on n'a trouvé aux environs de Paris que des individus jeunes ou de grandeur médiocre, mais qui se rencontre aussi en Piédmont et aux environs de Florence, d'où l'on en a des individus tout-à-fait developpés. La figure citée dans les vélins du Muséum représente un de ces derniers; c'est une coquille fort inéquilatérale, en cœur oblique, à valves fort épaisses, surtout vers la charnière, et qui a un décimètre de longeur (plus de 3 pouces et demi), sur une largeur de 92 millimetres (3 pouces 5 lignes).

Elle est ornée a l'extérieur de 22 à 25 côtes longitudinales, simples, aplaties, et qui vont en s'élargessant vers le bord supérieur des valves. Le bord interne de chaque valve est denté en scie; les crochets sont très-protubérans, recourbés et dirigés vers le corcelet on la place de là lunule. La charnière est fort épaisse, et offre sur un plancher un demi-diaphragme, deux dents oblongues, inégales, obliques, dirigées vers la crochet. Outre les deux impressions musculaires, on voit, dans chaque valve, sous le corcelet, une fossette arrondie qui semble être un point d'attache de quelque partie de l'animal.

"Les individus plus jeunes des environs de Paris sont un peu moins inéquilatéraux, moins oblique que ceux d'Italie; ils paroissent d'ailleurs leur resembler en tout. Ils constituent la variété β de cette espèce."

The localities given below for this species are for the typical form as represented by the figure cited.

Localities.—ALABAMA: Palmer's mill, Wilcox Co., bed 21, sect. p. 31; Josh Hunter's, Hamburg, between Snow Hill and Allenton, bed 19; on Pine Barren creek, S. of Snow Hill, bed 19; McConnico's, 1½ mi. S. W. of Palmer's mill, bed 18; Mr. Cole's, W. of Palmer's mill, bed 18; ½ mi. N. of Snow Hill, "off-set"; 1 mi. S. W. of Clayton, Barbour Co.; 1⅓ mi. N. E. of Clayton, Barbour Co.

GEORGIA: Near the mouth of Sandy creek, Chattahoochee river; base of Midway, Chattahoochee river.

At the last mentioned two localities the specimens have broad flat ribs but are crossed by strong or deeply impressed concentric lines.

Venericardia planicosta var. *smithi*, { Pl. 4, fig. 14; Pl. 5, figs. 1, 2.

Syn. *V. planicosta* Har., Geol. Surv. Ark., vol. ii, 1892, p. 42.
V. smithii Ald., Geol. Surv. Ala., 1894, p. 243, pl. 12, figs. 1, a, b.

Aldrich's original description.—"Shell large, solid, slightly transverse, inflated, inequilateral, strongly ribbed, beaks strongly recurved, elevated; ribs 32-35 on specimens figured, flat in central part, strongly tuberculated both on the anterior and posterior, more faintly marked on the central part; teeth nearly transverse, cavity of shell deep, margin crenulate, cicatrices slightly impressed.

"Differs from *V. alticostata* Con. (*transversa* Lea) in the flatness of the ribs. Fig. 1 is from a specimen in my collection, the other (1b) is in the State collection. Rather abundant. Named in honor of Dr. Eug. A. Smith."

The giving of this form a new specific name is justifiable or not, according to one's idea as to what constitute specific differences. If one should confine his attention to a few specimens collected at random from beds 18 and 19 at various places from Prairie Bluff to Allenton, it would be possible generally to say that certain forms have from 30 to 35 high narrow crenulated ribs, while others have from 26 to 30 lower, broader, smoother ones. Still the writer has experienced even in this limited area and geological horizon considerable difficulty in making this distinction. If, however, we widen our range both geographically and stratigraphically matters begin to become more seriously complicated. On the Chattahoochee river at the very base of the Midway, the lower, broader ribbed and more typical form is sharply marked with deep concentric lines. In the vicinity of Crainesville, Tenn., the ribs though high, narrow and crenulate, have decreased in number to 25 or 26. The specimens collected by Dr. Safford and referred to by Gabb (Jr. Ac. Nat. Sci. Phila., 1860, vol. iv, p. 395) as *C. subquadrata?* are a little different still;—the tops of the ribs are rounded or flattened and are about as broad as the interspaces, near the umbones, or in young specimens each rib is placed upon a low, broader rib somewhat after the nature of the costation in *V. alticostata* Con.; this feature soon dies out however, leaving the ribs as Gabb has remarked "of nearly the same shape as *C. planicosta* of the Eocene formation." To us the most remarkable feature of Dr. Safford's specimens is the paucity of ribs, numbering from 20 to 23 only. The compound ribbing and the crenulation on the superimposed ribs have been noticed in very young specimens of *V. planicosta* many times from different horizons and localities, but in these specimens it occasionally shows, though faintly, nearly to the margin. Although there is no doubt as to the affinity of these specimens, our collections from west Tennessee are too imperfect to determine the geographical range or importance of this form, hence we forbear from giving it a new varietal name.

We see no special reason for confounding the variety *smithi* with *alticostata;* the two seem quite distinct so far as our present collections and knowledge go.

It seems reasonable to suppose that when such a hardy animal as *V. planicosta* had been introduced into *terra nova* as it was in the Midway of our Southern States, it would, if the conditions were favorable, multiply rapidly, and as the sea changed or alternated from a limestone forming, to a sand or clay depositing medium, this vigorous species would naturally cast off varietal forms, and it is these with which we now have to deal.

Localities for typical *smithi.*—

ALABAMA: 1 mi. N. of Midway, old field, Wilcox Co.; 1 mi. S. of Palmer's mill; 1½ mi. S. W. of Palmer's mill; Cole's place, W. of Palmer's mill; Pine Bareen creek, 2 mi. S. of Snow Hill; Josh Hunter's, between Snow Hill and Allenton.

ARKANSAS and TEXAS: This variety is also found in the Midway of these States.

Localities of Dr. Safford's and like specimens.—

TENNESSEE: 2 mi. E. of Middleton; 2 mi. S. S. E. of Middleton.

ALABAMA: 2 mi. N. of Snow Hill.

GEORGIA: Not far above the mouth of Sandy creek, on the Chattahoochee river.

Localities of the specimens with about 25 narrow, high ribs.—

TENNESSEE: Hannah's, 1¾ mi. N. E. of Crainesville, beds *b*, *d* & *f;* Huddleston's; 3 mi. W. of Crainesville; ½ mi. W. of Hannah's; McDonald's mill, 4 mi. S. W. of Middleton.

MISSISSIPPI: Reeves, 2½ mi. N. W. of Walnut; Blue Mt.

ASTARTE.

Astarte smithvillensis var. *mediavia*, Pl. 5, fig. 4.

Var. of *A. smithvillensis* Har., Proc. Ac. Nat. Sci. Phila., 1895, p. 48, pl. 1, figs. 8, a; 9, a, b, c.

Harris' original description.—"Size and general form as indicated by the figures; surface in typical specimens marked by strong concentric rugæ especially towards the base; these slope gently above but abrupt below and are superimposed by fine striæ; umbones flattened.

"This species shows great variation in form and size as well as markings. At Collier's Ferry, some specimens are more elongated, others more rotund; some have crenulations on the interior submargin, while others are smooth. Several of these forms are shown by the figures cited.

"*Localities of the typical form.*—Devil's Eye, Colorado river, Bastrop Co.; Smithville, Bastrop Co., Texas.

"*Geological Range.*—Lower Claiborne Eocene.

"*Types.*—Texas State Museum."

The species for which the varietal name, *mediavia*, is proposed are more oval in outline than the typical form, the rugæ are less distinctly defined and are no more abrupt below than above; they have a tendency to disappear on the anterior and posterior parts of the shell. Yet the shape of the young shell and its markings as determined by the umbones of the adults in hand, and the fact that *smithvillensis* has the capability of extreme variation in one and the same horizon, have weighed strongly in causing this form to be regarded as but a variety of that species rather than as distinct and new.

Localities.—ALABAMA: Naheola Landing, Tombigbee river;
Matthews' Landing, Alabama river.

Type of the variety.—Lea Memorial Collection, Ac. Nat. Sci., Phila.

Astarte subpontis n. sp., Pl. 5, figs. 5, a, b.

Specific characterization.—Size and general form as indicated by the figures; extremely gibbous; marked exteriorly by concentric striæ near the beak, becoming stronger or fold-like near the lower margin; inner margin crenulate; teeth and muscular scars typical of the genus.

Locality.—GEORGIA: In the whitish limestone at the very top
of the Midway horizon as represented on the
Chattahoochee river. Common.

Type.—Paleontological Museum, Cornell Univ.

[illegible]

Astarte aldrichiana n. sp., Pl. 5, figs. 6, a.

Specific characterization.—General form and size as indicated by the figures; surface covered by strong, even, concentric lines; hinge of right valve with one strong umbonal tooth, before and behind which are pits for the teeth of the opposite valve; an anterior groove for a rather long anterior lateral and a posterior ridge answering for a posterior lateral, are present; shell polished within; muscular scars faintly impressed; marginal crenulation coarse.

This shell has the dentition of *A. concentrica* of the Miocene of Virginia. Except in size and faintness of muscular impressions this is an ordinary *Astarte*.

Locality.—ALABAMA: Dale's Branch, near Oak Hill, Wilcox Co.

Type.—Paleontological Museum, Cornell Univ.

CRASSATELLA.

Crassatella gabbi, Pl. 5, figs. 7, a, 8, 9 10, 11.

Syn. *C. pteropsis* Gabb, *non* Con., Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 395, pl. 68, fig. 28.
C. gabbi Safford, Am. Jr. Sci., II, vol. xxxvii, p. 368, 1864.
Crassatella sp. Harris, Geol. Surv. Ark., 1892, vol. ii, p. 43.
C. tumidula Ald., Geol. Surv. Ala., 1894, p. 242.

Gabb's original description.—"Subtriangular, flattened; beaks very small; in some specimens a slight depression in advance of the umbonal ridge, which is rounded; surface marked by heavy transverse ribs, which become faint on and behind the umbonal ridge; hinge rather small; muscular scars deeply impressed; cardinal margin straight, anterior margin regularly rounded, basal margin slightly sinuous, posterior subangular.

"*Dimensions.*—Length, .9 in., width, 1.4 in., height of valve, .2 in.

"*Locality.*—Ripley group, Hardeman Co., Tenn., Prof. Safford; and from the same formation at Eufala, Ala. Collection of the Smithsonian Institution, No. 553."

Gabb's description answers fairly well to the type specimen in Dr. Safford's collection, a figure of which is herewith given.

His "dimensions," however, were evidently taken from the Smithsonian specimen.

Since Conrad had previously proposed the name *pteropsis* for a species of *Crassatella*, it was eminently proper for Dr. Safford to rename this species in Gabb's honor.

Several years ago the writer encountered this species in the Midway of Arkansas, and from the great variety of forms it presented, supposed that there were two species. However, none were well enough preserved to admit of positive identification or clear description, hence they were passed by un-named.

In Texas one of the same forms has been found in the Midway on Brazos river. A manuscript name was proposed but the description was never printed. The figure of that form is given on pl. 5, figs. 10, 11.

If all the specimens in hand at present really represent but one species, as seems most likely, it presents a remarkable amount of, variation in shape and surface markings. In the type specimen and all specimens from near Middleton sent here by Dr. Safford, there are a dozen or more strong concentric folds on the medial and anterior portion of the valve, but posteriorly, or behind the sinus anterior to the umbonal ridge, the folds disappear and the shell is smooth.

The lower or basal portion of the valve is also smooth. Other specimens are covered with much finer folds to the basal margin, while on others the markings are nearly obsolete.

One internal feature of this species is worthy of note, viz., the extreme obliquity of the cartilage pit (see figures). This is practically the same as seen in *C. alæformis*. The last mentioned species, however, differs considerably from *C. gabbi*. Its umbones are flat, its lirations broader, and the length of the shell is far greater.

Localities.—TEXAS: Brazos river, at Cretaceous–Eocene contact; Brazos river, Milam–Falls Co. line (see pl. 5, fig. 10, 11); Rocky Cedar creek, public road crossing, Kaufman Co.; Briar creek, northern part of Gibb's survey, northern Milam Co.; near Webberville, Travis Co.

ARKANSAS: N. W. of S. E. ¼, Sect. 8, 1 S., 13 W., and half a mile S.; Sect. 36, 1 S., 16 W.

TENNESSEE: Type specimen, 2 mi. S. of Middleton (pl. 5, fig. 7, a); others 2 mi. E. of Middleton; Hannah's, 1¾ mi. N. E. of Crainesville, Hardeman Co., bed *b*; ½ mi. W. of Hannah's; Huddleston's, 3 mi. W. of Crainesville; McDonald's mill, 4 mi. S. W. of Middleton.

MISSISSIPPI: Reeves, 2½ mi. N. W. of Walnut.

ALABAMA: ? ¾ mi. W. of Prairie Bluff, bed *e* (casts only); ¼ mi. N. W. of Prairie Bluff, old field; 1½ mi. S. W. of Palmer's mill, at S. McConnico's; roadside, 1 mi. S. of Palmer's mill (pl. 5, fig. 8); 1⅓ mi. N. E. of Clayton.

GEORGIA: The station mentioned in my Arkansas Report, vol. ii, p. 43, as 3 mi. below the mouth of Pataula creek, is probably on the Georgia side of the Chattahoochee.

Crassatella sepulcollis n. sp., Pl. 6, fig. 1.

Specific characterization.—Size and general form as indicated by the figure; beaks, anterior, prominent, curving anteriorly; young shell nearly quadrangular and strongly marked with distant rugæ; becoming elongate and smooth with age; lunule deep, well but not sharply defined; escutcheon well defined, extending from beak to a little over two-thirds way to posterior–dorsal angle; post–umbonal slope broad; cartilage pit small, extending from beak to midway of the cardinal plateau; two cardinal teeth of left valve of equal size, lunule margin extending from beak downwards and outside of the anterior tooth, leaving a slight crease between the two, and then continuing downward with a slight inflection and forming a pseudo-lateral tooth; cardinal tooth in right valve large, triangular with a pit on either side for the reception of the teeth of the opposite valve; the margin of the escutcheon in this valve answering for a faint posterior lateral tooth; submargin generally smooth, but often crenulate at some little distance in from the actual periphery of the shell.

This species is very abundant in the vicinity of Graveyard hill, beds 15 and 16?. Its high, anteriorly located and curving beaks, its broad post–umbonal slope, its hinge characters, and size and general outline distinguish it from any other known form.

Localities.—ALABAMA: ½ mi. W. of Graveyard hill; 1 mi. N. of Allenton.

PROTOCARDIA.

Protocardia nicolletti var., Pl. 6, fig. 2.

Var. of *C. nicolletti* Con., Proc. Ac. Nat. Sci. Phila., 1841, p. 33.
C. nicolleti Con., Wailes' Ag. and Geol., Miss., 1854, pl. 14, fig, 6.

Conrad's original description of C. nicolletti.—"Cordate, ventricose, polished, with crowded, minute, impressed radiating lines; beaks central, summits very prominent; posterior margin nearly direct, slightly emarginate, posterior slope with larger striæ than the disk, and muricated with radiating rows of approximate, rather obtuse, slender and prominent tubercles. Length, 2½ inches. Height the same.

"For this splendid *Cardium* I am indebted to my distinguished friend, J. N. Nicollet. It was found in green clay at 50 feet in height on the right bank of the Washita river, Monroe county, Louisiana."

I am quite aware that this variety differs considerably from the typical form. In brief the differences may be stated as follows:

In the typical form the anterior and posterior dorsal margins are prominent, in the variety they are obliquely truncated; in adult typical forms the basal margin is often circular, in the variety nearly rectilinear.

The Lignitic specimens from Virginia and Alabama, named *P. lene* and afterwards *P. virginiana* by Conrad, have the general shape of this variety except that the umbones instead of being even more prominent than in *nicolletti* typical, are much smaller.

After having collected large numbers of this genus from different horizons it will be possible to speak more positively of these allied forms.

Localities of this variety.—

TENNESSEE: Hannah's, 1¾ mi. N. E. of Crainesville, bed *b;* Huddleston's, 3 mi. W. of Crainesville.

MISSISSIPPI: Blue Mt., S. W. of Ripley; Reeves, 2½ mi. N. W. of Walnut.

ALABAMA: Naheola, Tombigbee river, (Best specimens found here); 1 mi. N. of Prairie Bluff; Dale's Branch, near Oak Hill; 1 mi. S. W. of Clayton.

Specimen figured.—Paleontological Museum, Cornell Univ.

CHAMA.

Chama gainesensis n. sp., Pl. 6, figs. 4, a.

Specific characterization.—General form and size as indicated by the figure of the internal cast; valves of nearly equal size and very similar throughout; umbones sometimes much stronger than represented by the figure, distant; umbonal ridge fairly well marked, anterior to which, or nearly in the central portion of the valve, a slightly impressed, broad sinus extends from beak to base; exterior with strong, wide, rather thick and irregular lamellæ.

Locality.—GEORGIA: Uppermost bed of the Midway limestone as exposed on the Chattahoochee river at Ft. Gaines. Common.

Types.—Paleontological Museum, Cornell Univ.

ISOCARDIA.

Isocardia mediavia n. sp., Pl. 6, fig. 5.

Specific characterization.—Size and general form as indicated by the figure; beaks strongly in-rolled; umbonal ridge rather sharp above, but less so below; shell very ventricose, the depth of the valve figured being 12 mm.; surface smooth about the umbo, but marked with concentric lines towards the basal margin.

Traces of this species have been seen from the Midway limestone of Texas, and from the clays of Black Bluff, Tombigbee river, several years ago, but this is the first large, well preserved valve found.

Localities.—ALABAMA: Black Bluff, Tombigbee river; Matthews' Landing, Alabama river (Fig'd type); 1 mi. N. of Midway (horizon of bed 18, sect. p. 31).

MERETRIX.

Meretrix ripleyana, Pl. 6, fig. 6.

Syn. *Venus ripleyana* Gabb, Jr. Nat. Sci, Phila., vol. iv, 1860, p. 393, pl. 68, fig. 22.

Gabb's original description.—"Inequilateral; beaks small, anterior; cardinal margin strongly curved, anterior semicircular, basal and posterior regularly rounded, surface marked with regular transverse ribs.

"*Dimensions.*—Length .55 in., width .7 in., diameter .38 in.

"*Locality.*—Ripley group, Hardeman Co., Tenn. Prof. Safford."

Nearly all the type specimens of this species were from a clay bank 2 miles S. S. E. of Middleton, Tenn. One specimen, however, is from 2 miles E. of Middleton, and another is from the limestone on Muddy creek. The specimen that Gabb used in his description and which he figured is probably the one now represented by the blue clay filling, the shell having been exfoliated. However, several other fairly well preserved specimens show the character of the species. One is figured herewith. This is perhaps not quite so elongated as the majority of the specimens; there seems to be considerable variability in this regard. The concentric rugæ are fairly strong and regular from the middle of the valve downwards, while upwards towards the beaks the shell is nearly smooth. All the specimens from Dr. Safford are approximately the same. The lunule is rather narrow and long, giving that margin of the shell an unusual straightness from the umbo to the anterior end.

In Georgia casts of this species occur at the very base of the Midway on the Chattahoochee river, and thence to the mouth of Sandy creek. Another slightly larger variety occurs in the cuts north of Snow Hill, off-set of the section on p. 31.

Fig. 7 is from Huddleston's, 3 miles W. of Crainesville, Tenn. The same form occurs in U. S. Nat. Museum material brought from 4 miles N. E. of Kemp, Kaufman Co., Texas.

Meretrix sp.

While at work on the Arkansas and Texas State Surveys, the writer frequently found casts of this genus in the Midway limestones. Some of these were figured. They are so variable in form, however, that it has seemed and still seems unwise to attempt specific descriptions of them. In a future work it is intended to go over all Eocene genera systematically and the then accessible material will doubtless be far more satisfactory than that which we now possess.

The commonest *Meretrix* in the Alabama Midway is nearly circular in outline below, but with a very strong umbonal region, marked evenly on its exterior with concentric rugæ. This is a very common form in the horizon of beds 18 and 19 in Wilcox Co., and in the R. R. cut 1⅓ miles N. E. of Clayton, Barbour Co. It is also found in the limestone of Limestone Co., Texas.

TELLINA.

Tellina, Pl. 6, fig. 8.

The specimen shown by the figure was found with many others in bed *f*, at Hannah's, p. 18. Since all are mere casts it seems unwise to give them a new specific name.

Another species more like Aldrich's *T. triangularis* was found along the Chattahoochee. Doubtless more perfect specimens of both species will be found in the course of a few years.

CORBULA.

Corbula subcompressa, Pl. 6, fig. 9.

Syn. *C. subcompressa* Gabb, Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 394, pl. 68, fig. 24.

Gabb's original description.—"Subquadrate, beaks nearly central; umbones large, umbonal ridge angular, umbonal slope abrupt, anterior margin regularly rounded, posterior slightly sinuous, posterior subbiangular; hinge very small.

"*Dimensions.*—Length .14 in., width .22 in.

"*Locality.*—Two miles E. of Middleton, Hardeman Co., Tenn.

"This species resembles closely *C. compressa* Lea, from the Eocene of Ala., although it is undoubtedly distinct.

Both of Gabb's types are left valves. The specimen he figured is probably not the same one shown on pl. 6, fig. 9, but it has essentially the same form. In just the right light a trace of a radiating sinus is observable anterior to the umbones and another just anterior to the umbonal ridge.

Type specimens.—R. R. cut, 2 mi. E. of Middleton, Tenn., now in Dr. Safford's collection, Vanderbilt University, Tenn.

Casts of this species are common in the limestone ledges of the Midway on the Chattahoochee river above Sandy creek. They are slightly longer than the types. Another specimen from the basal layer is like the types. Higher in the Midway stage, at Matthews' Landing on the Alabama river, a thicker, higher form occurs which is doubtless the descendant of the typical form. Similarly higher forms occur in bed *f* at Hannah's, p. 18, and a more nearly typical form was figured by the writer from the Midway limestone of Arkansas; see Ann'l Rep't State Geol. Surv., 1892, vol. ii, pl. 1, fig. 6.

LUCINA.

Lucina claytonia n. sp., Pl. 6, figs. 10, a.

Specific characterization.—Size and general outline as indicated by the figures (of different individuals); surface but slightly striate near the umbones, but near the periphery showing several (4 to 5) distinct halts in the growth of the shell, finely and evenly striate between these growth lines; lunule small, impressed, ligamental groove large and deep, bordered posteriorly by a slightly elevated ridge in the right valve; cardinal teeth two in each valve; anterior lateral faint in either valve; muscular scars unequal as figured.

The figures are from gutta-percha impressions. Imprints of this species are very common in the limestone outcrop near Clayton.

This species varies somewhat in form but it generally has a trace of a posterior truncation. The shell is rather thin.

I know of no similar Eocene species with which this may be compared. In general outline it resembles some of the very large specimens of *Mysia ungulina* from Claiborne but its muscular scars remove it far from that form. In some respects perhaps this may be said to resemble *L. symmetrica* also from the Claiborne sands, but that is much larger, thicker, with differently shaped teeth and ligamental pit and is more nearly circular in outline; there are also several other points of difference.

Locality.—ALABAMA: R. R. cut, 1⅓ mi. N. E. of Clayton.

Types.—Paleontological Museum, Cornell Univ.

Lucina fortidentalis n. sp., Pl. 6, figs. 11, a.

Specific characterization.—Size and general form as indicated by the figures; surface marked by (10 to 12) sharp, raised, concentric, lamellar rugæ, between which are faint concentric lines;

both cardinal and lateral teeth well developed; right valve with one strong and one rudimentary anterior lateral and one strong and one rudimentary posterior lateral—all short, one cardinal tooth; left valve with two tooth-like projections fitting over both strong anterior and posterior laterals, and two cardinal teeth; ligament external, extending from the umbo to near the posterior lateral teeth; muscular scars as shown in the figure; inside of the valves coarsely punctate.

Localities.—ALABAMA: 1 mi. N. of Midway.
GEORGIA: Base of Midway, Chattahoochee river; soft layer of gray, micaceous clay with casts of large *Turritella mortoni*, not far north of the mouth of Sandy creek, Chattahoochee river.

GASTROCHÆNA.

Gastrochæna gainesensis n. sp., Pl. 6, figs. 12, a.

Specific characterization.—General form as indicated by the figures, though the posterior is represented as somewhat too narrow since the posterior-dorsal margin is broken away; size one-half that represented in the figures; shell extremely gibbous anteriorly, with a great anterior-basal opening; main face of shell somewhat more coarsely striate than anterior portion, *i. e.*, that in front of a vaguely defined line of flexture by no means as distinct as in *Martesia;* found as is common for this genus surrounded by a globular or pear-shaped incrustation.

Locality.—GEORGIA: Uppermost layers of the Midway limestone as exposed on Chattahoochee river at Ft. Gaines.

Type.—Paleontological Museum, Cornell Univ.

Gastrochæna cimitariopsis n. sp., Pl. 6, fig. 13.

Specific characterization.—General form as indicated by the figure; figure twice natural size; marked exteriorly by a few concentric undulations; a strong ridge extending from the umbo to the posterior-basal margin, posterior to the same the shell is nearly flat, with a trace of a radiating sinus; anterior-basal margin widely gaping; surrounded by an elongate globular covering like other members of the genus. Rare.

Locality.—GEORGIA: Uppermost bed of the Midway limestone as seen on Chattahoochee river at Ft. Gaines.

Type.—Paleontological Museum, Cornell Univ.

MARTESIA.

Martesia dalliana n. sp., Pl. 6, fig. 15.

Specific characterization.—General form as indicated by the figure which is 1⅔ natural size; subcylindrical in cross-section; strongly characterized by the faintness or practical absence of the groove that generally in this genus extends from the umbo obliquely backwards to the basal margin; anterior end narrow, covered with concentric, rather strong striæ, which as they pass around an anterior umbonal carina are bent downwards nearly at right angles, and again some distance below are deflected backwards; at the point of backward deflection there is a very faint trace of the groove mentioned above.

Locality.—GEORGIA: Near the base of the Midway stage on the Chattahoochee river not far above the mouth of Sandy creek.

Type.—Paleontological Museum, Cornell Univ.

VERTICORDIA.

Verticordia sp., Pl. 6, fig. 16.

The specimen figured being the only one obtained from the Midway it seemed best to defer its specific characterization until its relations with *V. eocense* Langdon, can be determined. It is very much smaller than Langdon's species and from the figure of it by Aldrich (Bull. Geol. Surv. Ala., No. 1, 1886, pl. 6, fig. 13), it is considerably different in form. How much of this difference may be due to age connot at present be determined.

Locality.—ALABAMA: 1 mi. W. of Oak Hill P. O., Wilcox Co.

Specimen figured.—Paleontological Museum, Cornell Univ.

PHOLADOMYA.

Pholadomya mauryi n. sp., Pl. 6, figs. 17, a.

Specific characterization.—General form as indicated by the figures; surface nearly smooth posteriorly, but marked on the anterior slope by several light costæ increasing in strength from those nearest the superio-anterior margin to those extending from beak to anterior margin on the right valve, inclined to alternate in size; posteriorly from the seventh or eighth of these strong ribs there are as many more faint ones on the medio-anterior portion of the shell; concentric undulations not strongly marked though present; superio-anterior margin suddenly reflected and highly elevated leaving a slight open space; anterio-subbasal margin entire as indicated by a perfect imprint of the right valve of the type; but strangely enough the lines of growth show that when young this margin was gaping and was filled by a callus plate as in *Pholadidea* when mature.

Though the dissimilarity in outline of this species to any known form is well marked, its other peculiarites are very closely represented by *Pholadomya cuneata.* Deshayes remarks regarding the latter species (Descr. des An. sans Vert., etc., 1858, vol. i, p. 277; see also pl. 9, figs. 6-8): "Ce qui la rend surtout remarquable, c'est une sorte de lobe médian, produit par une saillie considérable de l'angle supérieur des valves qui remonte entre les crochets, atteint leur hauteur et s'infléchit un peu vers eux; les valves laissent entre elles une fente longue et lancéolée qui commence au lobe supérieur et se termine vers le bord ventral [This feature is more noticeable in *cuneata* than in *mauryi*]; en examinant les stries d'accroissement, on s'aperçoit bientôt que dans le jeune âge le côté antérieur devait être ouvert largement à la manière de certaines Pholades, *Pholas dactylus* par example; des côtes longitudinales, partant du crochet, descendent en se courbant sur le côté antérieur, et viennent aboutir à la limite du bâillement de la coquille lorsqu'elle était jeune, et de ce point, au lieu de continuer à descendre, elles deviennent horizontales et même sont peu ascendantes; ces côtes étroites, egalement distantes, sont traversées par des stries transverses écartées, qui par leurs entre-croisement forment une sorte de réseau à grandes mailles; sur le côté postérieur les côtes disparaissent complétement, tandis que les stries transverses persistent. Le bâillement du côté postérieur est peu considérable, il semble même que la coquille est parfaitement fermée de ce côté; mais cela est produit probablement par une légère compression," etc., etc.

This and several other species of *Pholadomya* from the Thanet Sand may be seen in the collections of the British Museum; some of them occur too in a similar horizon in the Paris basin, horizon de Bracheux. It is therefore interesting to find in our Midway Eocene, a species conforming to *P. cuneata* in several noteworthy features, though specifically very distinct.

Localities.—TENNESSEE: Light gray sandstone layer at Hannah's (bed *b*), Hardeman Co. This sandstone shows numerous burrowings of this and other bivalves. Also from lower portion of section at Huddleston's.

Scaphopoda.

DENTALIUM.

Dentalium mediaviense, Pl. 7, figs. 1, a.

Syn. *D. mimutistriatum* Dall, *partim*, Trans. Wag. Fr. Inst. Sci., vol. iii, p. 438.

Specific characterization.—Size and general form as shown by the figures; surface nearly smooth near the greater extremity, though showing some irregular slight annulations; above, becoming longitudinally striate with alternating fine and coarse lines, annulations plainly visible and very regular; shell, about larger aperture very thin, but becoming very thick within half an inch of this extremity.

After examining hundreds of *D. minutistriatum* from typical localities in Texas, the writer noted in his MS. report on the Mollusca of that State that the Prairie creek, Ala., specimens had certain marked characters not possessed by *minutistriatum*. The Midway species are large, sometimes quite large and attaining a maximum diameter of ⅓ inch; their striation is very plainly alternate and sometimes becomes quite strong towards the apex; they have clearly defined and regular annulations; they are much more tapering than *minutistriatum*.

Localities.—MISSISSIPPI: ½ mi. N. of Ripley.
ALABAMA: Black Bluff; ½ mi. W. of Graveyard hill; ? Dale's Branch; 1 mi. N. of Allenton.

Type.—Paleontological Museum, Cornell Univ.

CADULUS.

Cadulus turgidus, Pl. 7, fig. 2.

Syn. *C. turgidus* Meyer, Bull. No. 1, Geol. Surv. Ala., 1886, p. 65, pl. 1, fig. 10.

Meyer's original description.—"Width of the shell rapidly increasing for about two-thirds of the entire length, and then more rapidly decreasing; section circular.

"*Locality.*—Matthews' Landing, Ala.

"Rather common; I received this shell from Mr. Aldrich. It differs by its very strong inflation from all the other species of *Cadulus* of the Southern Tertiary which I know of."

Localities.—ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill; Dale's Branch.

Gastropoda.

ACTÆON.

Actæon (*Tornatellæa*) *bella*, Pl. 7, fig. 3.

Syn.—*T. bella* Con., Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 294, pl. 47, fig. 23.

Conrad's original description of the sub-genus.—"Ovate, ventricose; columella with two slender, prominent folds, the lower fold not distinctly continuous with the margin of the base.

Specific description.—"Ovate; spire conical; revolving lines numerous, impressed, punctate-striate."

Conrad does not give the exact locality of this species, but we know it to be very abundant in the Lignitic of Alabama.

Localities.—MISSISSIPPI: 1 mi. N. of Ripley (see fig.)
ALABAMA: Black Bluff, Tombigbee river; 1 mi. N. of Midway, Wilcox Co.

Type.—Ac. Nat. Sci., Phila.

Actæon (*Tornatellæa*) *quercollis* n. sp., Pl. 7, fig. 4.

Specific characterization.—General form as shown by the figure; spire usually broken at apex, remaining whorls slightly shouldered above but becoming more rectilinear below, traces of lines of growth sometimes present, spiral striæ rather faint; body whorl somewhat shouldered, sides rather straight, spiral striæ fainter above and stronger below; columella in adult specimens with two well marked folds; aperture truncated anteriorly; labrum thin at margin, strongly lirate and varicose within.

Localities.—ALABAMA: The best specimens in hand are from the National Museum, Stations 264 and 283, Wilcox Co. They are doubtless from bed 9, section p. 31. Others in the University collection are from ½ mi. W. of Graveyard hill, Wilcox Co.
TENNESSEE: Small specimens, probably of this species, are from Hannah's, bed *f*, 1¾ mi. N. E. of Crainesville.

Type.—Collection U. S. Nat. Museum.

ATYS.

Atys robustoides?, Pl. 7, fig. 5.

Syn. *Atys robustoides* Ald., Bull. Am. Pal., No. 2, p. 6, pl. 2, figs. 4, 4a, 1895.

Aldrich's original description.—"Shell small, oval, subgibbous, striated, umbilicated; lines of growth numerous, more so on the posterior half of the shell; spirals numerous, more closely set at extremities and rather deeply cut, no pitting of the lines perceptible; posterior end rising above apex and partly covering the posterior pit; the callus twisting into a saddle shape to join the outer lip; spirals closely set where they run up into the umbilicus; pillar lip nearly straight.

"*Locality.*—Gregg's Landing, Alabama."

The little specimen shown by fig. 5 has been broken posteriorly, and it is difficult to identify it specifically with any form heretofore described. It is perhaps *A. robustoides* Ald., and is from 1 mile west of Oak Hill, Wilcox Co., Ala.

Specimen figured.—Paleontological Museum, Cornell Univ.

CYLICHNA.

Cylichna meyeri, Pl. 7, fig. 6.

Syn. *Cylichna meyeri* Ald., Bull. Am. Pal., No. 2, p. 6, pl. 2, fig. 5.

Aldrich's original description.—"Shell cylindrical, narrow, thin, lines of growth prominent and closely set on the posterior, becoming obsolete on the middle part of the shell; spiral lines numerous, closely set, impressed slightly and showing very faintly through the lines of growth at the posterior end; a deep excavation running from aperture at posterior over the apex and connecting to outer lip which projects above the opening, a strong rounded ridge marking the connection with the edge of whorl; aperture narrow at posterior, widening at anterior, the callus thickening but without a fold, umbilicus rudimentary.

"*Locality.*—Matthews' Landing, Ala.

"Differs from *C. dekayi* Lea by its groove at posterior, the sudden thickening of lines of growth and the absence of a fold. Named in honor of Dr. Otto Meyer."

The only specimen collected during the summer by us was from 1 mile west of Oak Hill P. O., Wilcox Co., Ala. Bed 9 of Oak Hill section, p. 31. It is fragmentary and is shown by fig. 6.

Type.—Aldrich's Collection.

Cylichna sp., Pl. 7, fig. 7.

An imperfect specimen of perhaps *C. galba* Con.; from Naheola, Tombigbee river, Ala.

Specimen figured.—Paleontological Museum, Cornell Univ.

PLEUROTOMELLA.

Pleurotomella whitfieldi, Pl. 7, fig. 8.

Syn. *Fusus? whitfieldi* Ald., Bull. Am. Pal., No. 2, 1895, p. 11, pl. 4, fig. 4.

Aldrich's original description.—"Shell thin, broadly fusiform, whorls ten, first four smooth, the next partly smooth and partly transversely ribbed, the balance angulated with ribs on the lower half of whorl; surface reticulated; the spiral lines alternate in size, very closely set, the smaller spiral line beaded on the body whorl; constricted at suture; outer lip sigmoid, smooth within; canal slightly bent.

"*Locality.*—Matthews' Landing and Gregg's Landing, Ala.

"This shell partakes so much of a Pleurotomid, I hesitate to put it under *Fusus*."

Found also 1 mile west of Oak Hill P. O., from the Matthews' Landing horizon, bed 9, section p. 31.

Type.—Collection of T. H. Aldrich.

Specimen figured.—Paleontological Museum, Cornell University. From 1 mi. W. of Oak Hill.

PLEUROTOMA.

Pleurotoma (*Surcula*) *adeona*, Pl. 7, figs. 9, 10.

Syn. *P. adeona* Whitfield, Am. Jr. Conch., 1, 1865, p. 262.

Whitfield's original description.—"Shell fusiform; spire moderately high; volutions five, deeply concave on the upper side, carinate in the middle and rounded below; ornamented on the carina by strong, oblique nodes, about fifteen on the body whorl; columella long, straight, and, with the aperture, forming more than half the length of the shell; entire surface marked by fine revolving striæ, and crossed by lines of growth having a deep retral curvature on the concave portion of the volution.

"*Locality.*—Nine miles below Prairie Bluff, Ala.

This species shows considerable variation as regards carinations and strength and form of spines. The figures show two forms. Others are broader and more sharply carinate.

Localities.—ALABAMA: Matthews' Landing; Dale's Branch, near Oak Hill; 1 mi. W. of Oak Hill; ½ mi. W. of Graveyard hill; 1 mi. N. of Allenton.

Type.—Hall collection or lost.

Specimen figured.—Paleontological Museum, Cornell Univ.

Pleurotoma (*Surcula*) *persa*, Pl. 7, fig. 11.

Syn. *P. persa* Whitfield, Am. Jr. Conch., vol. i, 1865, p. 262, pl. 27, fig. 4.

Whitfield's original description.—"Shell broadly fusiform; volutions seven or eight, concave on the upper side, and rounded below, leaving a rounded ridge just above the suture line; columella elongate, very slender, and bent a little backwards near the lower extremity; aperture elliptical, not quite as long as the canal below, the two together forming about one-half of the length of the shell; deeply notched in the upper part; surface marked with very fine, closely arranged revolving lines, which are crossed by fine lines of growth, having a strong retral curvature on the upper part of the volution.

"*Dimensions.*—Length of shell 1.12 inches, transverse diameter .35 inch.

"*Locality.*—Nine miles below Prairie Bluff, Ala."

By this Whitfield means Matthews' Landing. It is also found abundantly by the roadside, 1 mi. W. of Oak Hill P. O.; also in Dale's Branch.

Type.—J. Hall collection.

Specimen figured.—Pal. Mus., C. U.; from Matthews' Landing.

Pleurotoma (*Pleurotomella?*) *anacona*, Pl. 7, fig. 12.

Syn. *P.* (*Pleurotomella*) *anacona* Harris, Proc. Ac. Nat. Sci., Phila., 1895, p. 56, pl. 4, fig. 4.

Harris' original description.—"General form as figured; whorls 8; 1 nearly or quite smooth; 2, 3, 4, 5, 6 with (*a*) a broad slightly concave band showing very faint spiral striæ and a deep retral curve in the longitudinal striæ, (*b*) a slight basal carina with two or three strong spiral lines and rather faint, slightly oblique nodules; body whorl with more or less alternating coarse and fine spiral lines from the nodose carina to the end of the beak.

"*Localities.*—Well at Elgin, northeast corner of Bastrop county; Smiley's Bluff, Brazos river, 2 miles above Pond creek, and perhaps on Rocky Cedar creek, 5 miles west of Elmo.

"*Geological horizon.*—Midway Eocene."

Type and specimen figured.—Texas State Museum.

This form resembles somewhat *Pl. adeona* Whitf., but differs by its longer form, smoother surface and the position of the posterior canal.

Pleurotoma (*Surcula*) *ostrarupis*, Pl. 7, fig. 13.

Syn. *Pl. ostrarupis* Harris, MS. prepared for 5th Ann'l Rep't Geol. Surv. Tex., pl. 15, fig. 5.

Harris' original description.—"This is only a fragment and cannot be fully characterized. The more obvious and peculiar features are: (*a*) the rather fine, oblique, and somewhat curved longitudinal costæ which in all probability disappear on the larger whorls of adult, and (*b*) the regular spiral striation.

"*Locality.*—Sta. 104, Smiley's bluff, Brazos river, two miles above the mouth of Pond creek, Milam Co.

"*Geological horizon.*—Midway Eocene.

"In the collection of the U. S. Nat. Mus., a specimen occurs among others marked '*Pleurotoma persa* Whitf.' by Aldrich. All came from Matthews' Landing. This particular specimen is evidently not *P. persa*, but, as far as can be determined, should be labelled *P. ostrarupis.*"

This species is quite common in material from Matthews' Landing. When entire the general outline of the shell is not far from that of *Pl. anacona.* A small specimen is in the Pal. Mus., C. U., from 1 mile west of Oak Hill.

Type.—Texas State Museum.

Pleurotoma sp., Pl. 7, fig. 14.

This seems to be the forerunner of the Wood's Bluff form called by Heilprin in Proc. Ac. Nat. Sci., Phila., 1880, p. 374, "*Pleurotoma acuminata?* Sowerby." Its spire is not so high as the Lignitic form, and its costæ are fewer and more prominent, and its columella is more deflected at base. Nevertheless, since but one specimen of this variety is at hand, it seems inadvisable to designate it at present by any particular name.

Locality.—ALABAMA: Dale's Branch, near Oak Hill, Wilcox Co.

Specimen figured.—Paleontological Museum, Cornell Univ.

Pleurotoma longipersa n. sp., Pl. 7, fig. 15.

Specific characterization.—General form as indicated by the figure; spire of about seven whorls; 1, 2 and 3 smooth, 4 costate, these are embryonic; remaining spiral whorls with a subsutural band traversed by a revolving line, below with fine lines of growth and alternating spiral lines; carinations of 5 and 6 obliquely and faintly costate.

This species resembles *P. persa* and *P. gabbi;* from the former it is distinguished by its much more constricted sutures and the subsutural band; from the latter it differs in having more constricted sutures, by having a tendency to costation in the upper spiral whorls, not embryonic.

Locality.—ALABAMA: Matthews' Landing.

Type.—Paleontological Museum, Cornell Univ.

Pleurotoma mediavia n. sp., Pl. 7, fig. 16.

Specific characterization.—General outline as shown by the figure; two embryonic whorls small, smooth, a third and a part of the fourth are longitudinally costate, finely so at first but becoming coarser below; on the four sub-embryonic spiral whorls there is a submedial carina traversed by fine costations not so sharply biangular as in *Pl. denticula* or *Pl. alternata*, but recalling those in *Pl. waterkeynii* as shown on pl. 30 of Edwards' Eocene Mollusca of England, 1860; spiral and longitudinal lines fine, though just beneath the carina the spirals are apt to be coarser; costations traversed by four fine spiral lines; costæ nearly obsolete on the body whorl.

A very closely related but larger form from Wood's Bluff has three lines traversing the costæ, while *Pl. alternata* and *Pl. childreni* have but two.

Locality.—ALABAMA: 1 mi. W. of Oak Hill P. O., Wilcox Co.

Type.—Paleontological Museum, Cornell Univ.

Pleurotoma (*Cythara?*) *leania* n. sp., Pl. 7, fig. 17.

Specific characterization.—Size and general form as indicated by the figure; three or four embryonic whorls, the lower two of which are longitudinally costate; remaining two spiral whorls costate and strongly striate spirally with lines of alternate strength; body whorl with ribs dying out submedially, slightly shouldered above, retral sinus very shallow; columella long, slightly deflected. The shell has a decided Fusoid appearance.

Locality.—ALABAMA: Matthews' Landing, Alabama river.

Type.—Lea Memorial collection, Ac. Nat. Sci., Phila.

Pleurotoma (*Drillia*) *quercollis*, Pl. 7, fig. 18.

Specific characterization.—Size and general form as indicated by the figure; whorls about 10; 1 and 2 smooth, 3 and 4 longitudinally costate; remaining spiral whorls marked by about 12 costæ, and by two strong spiral raised lines or carinæ on the larger part of the whorl and one subsutural line; body whorl marked like the spiral whorls, the costæ dying out subcentrally;

columella slightly curved; retral sinus very moderate.

This is a very small and beautifully sculptured species.

Locality.—ALABAMA: 1 mi. W. of Oak Hill P. O., Wilcox Co.

Type and specimen figured.—U. S. Nat. Museum collection.

The type is labelled simply Sta. 283, Wilcox Co., but doubtless came from the same locality as our University specimens.

OLIVELLA.

Olivella mediavia n. sp., Pl. 7, fig. 19.

Specific characterization.—General form and size as indicated by the figure; whorls about 7; the first extremely small, the second much larger, and the third still greater, producing a blunt appearance; remaining spiral whorls nearly or quite covered by the sutural callosity; body whorl smooth, but the direction of the lines of growth can be traced with a glass; growth lines slightly geniculated about three-fourths of the way from the suture to the anterior folds at a faint depression which produces a faint tooth on the margin of the outer lip; columella well twisted below where it is 7-8 striate; above on the columella there is often a large obtuse fold which marks a former position of the upper margin of the slit for the anterior canal.

Localities.—ALABAMA: 1 mi. W. of Oak Hill (Type); Matthews' Landing; ½ mi. W. of Graveyard hill; Black Bluff, Tombigbee river; ? 4 mi. below Black Bluff.

Type.—Paleontological Museum, Cornell Univ.

CARICELLA.

Caricella leana, Pl. 7, fig. 20.

Syn. *Scaphella* (*Caricella*) *leana* Dall, Trans. Wag. Fr. Inst. Sci., vol. iii, p. 86, pl. 6, fig. 9, 1890.

Dall's original description.—"Shell small, elongate-fusiform, of five or six whorls; nucleus small with a distinct spur or elevated point (which formation may conveniently be termed the *calcarella*) and composed of one whorl; suture closely appressed, the whorl somewhat constricted in front of it; the whole shell sculptured with small, subequal, close-set flattish spiral threads across which the incremental lines are hardly perceptible; aperture longer than the spire, narrow, with a faint recession at the suture (* * * * *) and a long, narrow, straight canal; pillar with no siphonal fasciole, a thin glaze anteriorly, and four thin, sharp, well-elevated plaits of which the anterior is the least pronounced; canal not constricted off; outer lip simple. Lon. of shell 26.0; of aperture 18.0; max. lat. of shell 8.0 mm.

"Lower Lignitic series, Prairie Creek, Wilcox Co., Alabama, in the clays (No. 5) just above the Nautilus rock or Enclimatoceras limestone."

It is quite possible that Dall's specimen came from the clay immediately overlying the Nautilus rock, *i. e.*, bed 16 of our section p. 31. Ours, however, (pl. 7, fig. 20) came from Dale's Branch, bed 9; and from the confused state of Johnson's locality labels, it is quite possible that Dall's specimen came from bed 9. Certainly there is much misconception of the true relations of the Midway Eocene when it is stated that "The Nautilus rock is the first fossiliferous Eocene bed, and lies immediately over the Cretaceous Ripley beds," l. c., p. 86.

SCAPHELLA.

Scaphella showalteri, Pl. 7, fig. 21.

Syn. *Voluta showalteri* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 28, pl. 3, fig. 14.
Scaphella showalteri Dall, Trans. Wag. Fr. Inst. Sci., vol. iii, p. 80, 1890.

Aldrich's original description.—"Shell oval, oblong; whorls five; spire blunted; surface smooth and shining; lines of growth hardly perceptible; suture moderately impressed.

"Body whorl and next succeeding shouldered, bearing thereon numerous small tubercles; above the shoulder they are concave.

"Aperture two-thirds the length of the shell; columella four plaited—the upper one transverse, the middle ones oblique and larger. Outer lip smooth.

"*Locality.*—Matthews' Landing, Ala.

"This species is a true Volute, and belongs to the section *Vespertilio* Klein—Rare.

"Named in honor of Dr. E. R. Showalter, of Point Clear, Ala."

Localities of specimens in the Paleontological Museum of Cornell University.—ALABAMA: Matthews' Landing (figured specimen), Alabama river; Naheola Landing, Tombigbee river; Dale's Branch, near Oak Hill.

Scaphella sp., Pl. 7, fig. 23.

We have not good enough specimens of this species to warrant a specific description. It has seemed best to call attention to the existence of such a species so that others may find better or more determinable specimens.

Locality.—MISSISSIPPI: ½ mi. N. of Ripley. See p. 24, bed *e*.

Specimen figured.—Paleontological Museum, Cornell Univ.

VOLUTA.

Voluta lyroidea, Pl. 7, fig. 22.

Syn. *Volutilithes lyroidea* Ald., Geol. Surv. Ala., 1894, p. 245, pl. 13, fig. 7.

Aldrich's original description.—"Shell short, fusiform surface strongly ribbed with about eight plications ending rather abruptly at suture, giving the shell a shouldered appearance, no spiral lines observable, surface smooth, suture strongly impressed, spire missing in the type. The ribs are not continuous from one whorl to the other but alternate; body whorl large, ending in a short recurved canal. Aperture oblong.

"This species has a general resemblance to *Volutilithes rugatus* Con., but lacks the long canal, and has no spiral sculpture. The aperture is too imperfect to determine the exact generic position. It may turn out to be a *Lyria*.

"Length of part remaining 30 mm.; breadth 14 mm. Type in the National Museum."

Localities.—ALABAMA: Palmer's mill, see frontispiece; W. W. McConnico's plantation, 1½ mi. S. W. of Palmer's mill.

Voluta florencis n. sp., Pl. 8, figs. 6, a.

Specific characterization.—Size and general form as indicated by the figures; whorls unknown at apex, lower ones marked by about 7-9 plications, narrower than the interspaces, subacute, strongest at base of whorls; body whorl with 9 longitudinal plications, strong and subacute on the largest portion of the whorl but dying out rather rapidly below and reappearing above with some force near the suture; columella with four strong, nearly equal, oblique plaits, above which there are sometimes traces of three faint ones; anterior canal strongly deflected as in *V. muricina* Lam.; substance of the shell very thick.

The columellar and canal features are determined by means of the cast shown in fig. 6, a. A gutta-percha mould of the same individual is shown by fig. 6. The plaits shown in the latter figure are restored from the cast, fig. 6, a. As we have but few specimens it is not possible to give the apical features, but in so much as the plaits, the exterior marking and the absence of liræ on the interior of the outer lip are all indicative of this genus we think it can be placed here with little doubt.

Localities.—ALABAMA: Light yellowish limestone in a R. R. cut, 1⅓ mi. N. E. of Clayton.
GEORGIA: Base of Midway limestone, Chattahoochee river, about 3 mi. S. of the mouth of Pataula creek.

Type.—Paleontological Museum, Cornell Univ. Type from 1⅓ mi. N. E. of Clayton.

VOLUTILITHES.

Volutilithes rugatus, Pl. 8, fig. 1.

Syn. *V. rugatus* Con., Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 292, pl. 47, fig. 32.

Conrad's original description.– "Fusiform; spire somewhat elevated; volutions eight, convex, with minute, reticulated lines, the revolving lines microscopic; larger revolving lines prominent; ribs on the body whorl irregular, wanting near the base; an impressed line revolves below the suture, giving that part of the shell between this line and the suture an obscurely or obtusely carinated character; revolving lines on the body whorl distinct, a deposit on the inner lip; columella with three approximate, obtuse folds, the middle one obsolete; aperture narrow.

"Length 2 inches."

Conrad omits to mention the fact that the humeral region of the costæ is often very much developed, showing a tendency to become bluntly spinous.

Localities.—TEXAS: A few fragments seemingly of this species.
ALABAMA: Black Bluff, and 4 miles below, Tombigbee river; Matthews' Landing; Dale's Branch; 1 mi. W. of Oak Hill P. O.

Volutilithes rugatus var. *saffordi*, Pl. 8, fig. 2.

Syn. *Fasciolaria saffordi* Gabb, Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 390, pl. 68, fig. 6.

Gabb's original description.—"Fusiform, spire? (broken in all the specimens); suture distinct; mouth linear, columella slightly recurved and with three small oblique folds, inner lip slightly thickened at the upper part; surface marked by longitudinal ribs, (about eleven on the body whorl), crossed by numerous revolving lines.

"*Dimensions.*—Length of the body whorl of the smallest, but most perfect specimens, .6 in.; width of ditto, .4 in.; length of mouth, .55 in."

The locality from which Gabb cites this species is "Hardeman Co., Tenn." and its geological horizon, "Ripley Group."

This is characterized by a strong subsutural row of short tubercles located at the upper termination of the well defined ribs. Below this row the body whorl has a rather prominent shoulder; on the shoulder and below there are three rather strong rows of tubercles, while the revolving lines below carry only slightly thickened nodes as they cross the ribs. The columellar plaits are normally: one strong one, with a weaker one above; between these two there is often a small one, and there are several smaller ones above the weak one just mentioned.

Localities.—TENNESSEE: Hannah's, 1¾ mi. N. E. of Crainesville, bed *b;* Middleton, and two miles to the S. S. E. (Type fig'd).
ALABAMA: Naheola; Palmer's mill, bed 21, sect. p. 31; ½ mi. W. of Graveyard hill; 1 mi. N. of Midway.
GEORGIA: ? Ft. Gaines, Uppermost layer of Midway.

Volutilithes limopsis, Pl. 8, fig. 3.

Syn. *V. limopsis* Con., Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 292, pl. 47, fig. 24.

Conrad's original description.—"Subfusiform; volutions seven; body whorl longitudinally ribbed; ribs angular, acutely tubercular on the upper part; revolving lines prominent, acute, more salient where they cross the ribs, about twenty-seven in number; whorls of spire slightly convex, five series of tubercles on last volution; aperture narrow-elliptical; inner lip with a thin, wide deposit; columella with three plaits, the superior one obsolete or very small.

"Length 1⅜ inches. Diameter ⅝ inch.

"A beautiful species resembling *V. crenulata* Lam., or more nearly *V. ambigua*, but it has a more fusiform shape than either, a norrower aperture and dissimilar folds on the columella."

Localities.—TEXAS: Elgin, Bastrop Co.
ALABAMA: Matthews' Landing, 1 mi. W. of Oak Hill.

Type.—Ac. Nat. Sci., Phila.

Volutilithes quercollis n. sp., Pl. 8, fig. 4.

Specific characterization.—Size and general form as indicated by the figure; whorls 7; 1 and 2 smooth; the remainder with somewhat arcuate costations; lines of growth extremely minute, longitudinal, *i. e.*, not oblique, hence occasionally crossing the oblique costæ; sunken spiral lines very faint just below the suture, then occurring in pairs over the rest of the whorl; between each pair on each costa a nodose projection is formed giving the shell a rough appearance; columella with one, and perhaps two, rather strong folds and traces of smaller ones; costation evanescent on lower part of body whorl.

Locality.—ALABAMA: Dale's Branch, near Oak Hill.

Type.—Paleontological Museum, Cornell Univ.

LYRIA.

Lyria wilcoxiana, Pl. 8, fig. 5.

Syn. *L. wilcoxiana* Ald., Geol. Surv. Ala., 1894, p. 243, pl. 12, fig. 4.

Aldrich's original description.—"Shell rounded fusiform, whorls four, spire blunt, first three whorls smooth, body whorl transversely ribbed, the ribs rather sharp with concave spaces; no spiral sculpture shown; suture distinct, not deeply impressed; body whorl long terminating in a canal, which is missing in specimen figured; aperture long and narrow, inner lip showing a few plications, but the aperture is filled in so that the lips are almost completely hidden.

"Specimen is partially silicified. Prof. Dall refers to this species, but without describing it in Trans. Wag. Fr. Inst. Sci., vol. iii, p. 69. Type in National Museum."

According to Mr. Aldrich's notes elsewhere in his article, the locality for this species is on or near McConnico's plantation, Wilcox Co., Ala.

A specimen in our collection from 1 mi. N. of Midway is probably of this species, but has a slightly higher spire and so far as can be determined has no columellar plaits.

MITRA.

Mitra subpontis n. sp., Pl. 8, figs. 7, a.

Specific characterization.—General form and size as indicated by the figures; whorls about 7; apex acute; spiral whorls smooth, slightly inflated; suture distinct but not deep; body whorl with spiral striation at base and generally with one varix; outer lip thickened; columella with four strong subequal folds below and two or three smaller ones above.

The folds on the columella of this species resemble those of some groups of Volutes, but the general form is that of the *Mitræ*, and the apex is acute. The varix is remarkable for this genus or allied genera.

Localities.—GEORGIA: Uppermost beds of the Midway horizon as represented on the Chattahoochee at Ft. Gaines. Specimens are not rare, though by no means abundant.

Type.—Paleontological Museum, Cornell Univ.

Mitra hatchetigbeensis?, Pl. 8, fig. 8.

Syn. *M. hatchetigbeensis* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 28, pl. 6, fig. 3.

This form has considerable resemblance to *M. hatchetigbeensis* but so far as observed has but two plaits on the columella instead of three. The specimen herewith figured is from Black Bluff, Tombigbee river, Sta. 297, of U. S. Nat. Mus. Record. Less perfect specimens were collected from the same locality by Hubbard and Harris, 1895.

FUSUS.

Fusus quercollis n. sp., Pl. 8, fig. 9.

Specific characterization.—Size and general form as indicated by the figure; whorls, probably about 10, strongly carinated, smooth above, with about twelve tooth-like, vertically compressed tubercles on the carina; below the same a short distance a strong spiral, raised line, still lower, a second somewhat fainter and below this a third corresponding to the suture of the next whorl. On the body whorl the first spiral line below the suture is also fairly strong but the succeeding spirals are fainter and disappear entirely on the anterior canal, which is extremely long, straight and slender. The lines of growth are evident on specimens of this species but they are not crossed by fine spirals, hence the shell has a polished appearance above the carina and between the strong spiral lines.

Localities.—MISSISSIPPI: ½ mi. N. of Ripley.
ALABAMA: 1 mi. W. of Oak Hill P. O., Wilcox Co.

Type.—Department of Paleontology, Cornell Univ.

Fusus hubbardanus n. sp., Pl. 8, figs. 10, 11.

Specific characterization.—General form and size as indicated by the figures; whorls at least 10; ornamented by (*a*) spiral lirations, about five very strong ones below the shoulder, with an equal number of fainter alternate striæ, and five or six faint ones above, growing fainter as they approach the suture; (*b*) by obtuse nodular costations, 14 on the penultimate whorl, strong at the shoulder but dying out rapidly above, less rapidly below; lines of growth fine but well marked, especially on the body whorl. On the last mentioned whorl the nodular costæ are faint and confined to the humeral angle; the spiral lirations below, about 10 in number, are strong; columella long, straight. Suture more or less filled by a revolving ridge.

Localities.—MISSISSIPPI: Bed *e*, ½ mi. N. of Ripley, see p. 23.
ALABAMA: ? Palmer's mill, Wilcox Co.

Type.—Paleontological Museum, Cornell Univ.

Fusus meyeri var., Pl. 8, fig. 12.

Syn. *F. meyeri* Ald., Bull. No. 1, Geol. Surv. Ala., p. 21, pl. 3, fig. 12.

Aldrich's original description.—"Shell elongate fusiform; spire slender, acute; whorls fourteen; surface of the spire and body whorl with seven longitudinal broadly rounded folds, which are spirally arranged, crossed by raised rounded striæ, generally seven in number, rather distant, the central one making a sharp carina on the center of each whorl, with erect longitudinal tubercles at the intersections; spaces between striæ showing only lines of growth; canal very long, spirally striated with alternate raised lines; lines of growth very numerous and almost obsolete; mouth small, oblong-ovate; outer lip incurved, smooth.

"*Locality.*—Lower bed, Woods' Bluff, Ala.; Matthews' Landing, Ala.

"The figured type retains four embryonic whorls; three are smooth, the fourth longitudinally striate. The Matthews' Landing form is smaller and even more beautiful. One specimen has the ribs obsolete on the upper half of the whorls and the periphery armed with erect longitudinal spines, giving the shell a very strongly carinate form. *Fusus mississippiensis*, Con., from Vicksburg, resembles this form, but this is more carinate, with longer canal and spire; the latter species has many more revolving lines, and the outer lip is striate internally. Named in honor of Dr. Otto Meyer.''

The specimens from the Matthews' Landing horizon are very different from those from Wood's Bluff. The body whorls are not so widely different as are the spires. In the Matthews' Landing—Oak Hill type there are as high as 18 costæ on some of the whorls. They are sharp, well defined, direct from the suture to the sharp carina. In the Wood's Bluff forms the costæ on the spire number the same as on the body whorl, about 7 or 8; they are also of the same form. Again, in the Wood's Bluff forms there is no tendency for the third line below the keel to become very prominent as it does in the Matthews' Landing specimens. It is possible the two may be united by intermediate forms, but there is reason certainly for doubting it. The Wood's Bluff forms resemble closely *F. unicarinatus*.

Type.—Collection of T. H. Aldrich.

Specimen figured.—1 mi. W. of Oak Hill, Ala. The same variety is also found in Dale's Branch.

Fusus ostrarupis, Pl. 8, fig. 13.

Syn. *F. ostrarupis*—Proc. Ac. Nat. Sci., Phila., 1895, p. 72, pl. 7, fig. 3.

Harris' original description.—''General form as figured; whorls 8; 1 and 2 smooth and polished, 3 sometimes polished, with long, undulating costæ, 4, 5, 6, 7 evenly striate spirally, and with seven or eight longitudinal costæ; costæ decreasing in size, about or just below the suture where a slightly depressed zone occurs; body whorl with eight or ten costæ, somewhat variable in size, subsutural zone much compressed, spiral striæ moderately even but slightly strongest on the largest part of the whorl; labrum strongly striate within; columella recurving; umbilicus rudimentary.

''*Locality.*—Smiley's Bluff, Brazos river, 2 miles above the mouth of Pond creek, Milam Co., Tex. Oyster Bluff of Penrose's Report.

''*Geological horizon.*—Midway Eocene.

''*Type.*—Texas State Museum.''

Fusus tortilis, Pl. 8, fig. 14.

Syn. *Fusus tortilis* Whitf., Amer. Jr. Conch, 1, 1865, p. 260, pl. 27, fig. 5.

Whitfield's original description.—"Shell elongate fusiform; spire slender, especially in the upper part, consisting of seven or eight subangular volutions, each marked by six strong longitudinal folds or varices, which are spirally arranged, those of one volution being a little behind the corresponding one of the preceding volution, the whole making about one-fourth of a turn in the length of spire; canal long and straight, making with the narrow ovate aperture, rather more than one-half of the entire length; surface marked by somewhat alternating revolving lines, strongest on the largest part of each volution.

"*Dimensions.*—Length 1.75 inches, transverse diameter .7 inch.

"*Locality.*—Nine miles below Prairie Bluff, Ala."

Type.—Hall collection.

Localities.—MISSISSIPPI: 1½ mi. E. of Ripley (probably of this species).
ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill; Dale's Branch.
GEORGIA: Uppermost layer of Midway limestone at Ft. Gaines.

Fusus mohri, Pl. 8, fig. 15.

Syn. *F.? mohri* Ald., Bull. Am. Pal., No. 2, 1895, p. 12, pl. 3, fig. 6.

Aldrich's original description.—"Shell broadly ovate, apex pointed; whorls ten, the first five very small, smooth, the sixth partially so passing into the adult stage; adult whorls with six strongly developed transverse ribs which are angular at the periphery; spiral sculpture coarse, more so at the junction with the ribs, making each one to terminate in a rounded and beaded projection broader at the point than elsewhere; columella straight, slightly thickened at the lower half of the aperture; canal straight.

"*Locality.*—Matthews' Landing, Ala."

Fragments indicate that this species often attains a length of four or five inches. In adults the peristome has a broad sinus at the carina and the lip is there slightly reflected.

Localities.—ALABAMA: Naheola, Tombigbee river; Matthews' Landing; 1 mi. W. of Oak Hill P. O.; Dale's Branch.

Type.—Aldrich's collection.

EXILIA.

Exilia pergracilis, Pl. 9, fig. 1.

Syn. *E. pergracilis* Con., Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 291, pl. 46, fig. 34.

Conrad's original description.—"Narrow-fusiform; volutions twelve, convex, with slightly curved, numerous, narrow ribs, and fine closely-arranged revolving lines; spire rather longer than aperture, first two whorls smooth; beak perfectly straight, minutely striated to the extremity.

"*Locality.*—Alabama. Dr. Showalter."

This species sometimes attains a length of 1½ inches or even more, but generally it is not over 1 inch long,

Localities.—MISSISSIPPI: ½ mi. N. of Ripley.
ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill P. O.; Dale's Branch.

Type.—Phila. Ac. Nat. Sci.

PYROPSIS.

Pyropsis perula, Pl. 9, fig. 2.

Syn. *Pyropsis perula* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 25, pl. 3, fig. 4.

Aldrich's original description.—"Shell depressed above, spinous; whorls seven; spire flat, showing only the upper part of the whorls; suture partially concealed by the spines of the next succeeding whorl overlapping.

"Surface covered with strong, transverse, raised, cordlike lines, which are armed with short, erect spines on the canal, becoming obsolete at its base. Spines erect, closed, flaring upward and circling the periphery of the body whorl, the one nearest the aperture being the largest. Aperture ovate; outer lip cut by the transverse lines, smooth within; labium strongly reflected, smooth, suddenly expanding at the anterior end of aperture; callus becomes thick in old specimens; canal long and narrow.

"*Locality.*—Wood's Bluff, Ala., in lower bed; also Matthews' Landing, Ala.

"The largest specimen, if perfect, would be (2″) two inches broad and over (4″) four inches long."

Localities.—ALABAMA: Dale's Branch; 1 mi. W. of Oak Hill; Matthews' Landing.

The specimen figured herewith is very small and imperfect but it suffices to show that the species is present in the Matthews' Landing horizon as far east as Dale's Branch, near Oak Hill P. O. A very large, perfect specimen from Wood's Bluff is now being figured by Dr. McConnell of Washington.

Type.—Aldrich's collection.

Specimen figured.—Dale's Branch.

STREPSIDURA.

Strepsidura heilprini, Pl. 9, fig. 3.

Syn. *S. heilprini* Ald., Bull. Am. Pal., No. 2, 1895, p. 12, pl. 4, fig. 1.

Aldrich's original description.—"Shell short, stout; whorls nine, first four smooth, embryonic, the fifth costate, the others with about six profoundly raised and rounded transverse ribs; surface reticulated, apex pointed; outer lip striated within; columella twisted, bearing at the narrow part far within a single fold; canal extremely twisted and turned upward at base.

"*Locality.*—Matthews' Landing, Ala."

Type.—T. H. Aldrich's collection.

Our collection includes specimens from Matthews' Landing and 1 mile west of Oak Hill P. O.

Specimens of a different, though somewhat related species were collected at Black Bluff, on the Tombigbee.

Strepsidura? mediavia n. sp., Pl. 8, figs. 16, a, 17.

Specific characterization.—Size and general form as indicated by the figures; whorls probably about 6; spiral whorls ornamented by about 8 basal nodular ribs and about an equal number of revolving lines; body whorl showing 9 or 10 rounded ribs, strongest on the carina, dying out above and becoming faint below; spiral striation above the carina, distinct but much finer than that below; lines of growth fine, swinging backward from the suture to the carina, thence curving slightly forward again and finally recurving, as in *Levifusus;* columella with a *Fulgur*-like angle upon which are located one strong, very sharp, basal plait and one less distinct, above. In old, large specimens the columella is large and umbilicate.

The general form of this species with its long anterior canal not sharply reflected, and the presence of an umbilicus render the reference of this species to *Strepsidura* not certain; yet unless a new genus is proposed we are at a loss to know where it can better be placed.

Localictes.—ALABAMA: On McConnico's plantation, 1½ mi. S. W. of Palmer's mill; roadside, 1 mi. S. of Palmer's mill.

Type.—Paleontological Museum, Cornell Univ.

LEUCOZONIA.

Leucozonia biplicata, Pl. 9, fig. 4.

Syn. *L. biplicata* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 23, pl. 5, fig. 15.

Aldrich's original description.—"Shell broadly fusiform; whorls six—nucleus composed of two smooth whorls, those remaining covered with revolving, somewhat alternating raised lines and strong longitudinal ribs, which give the shell an angular appearance. Outer lip sinuate, thickened internally, finely crenated; columella bearing two erect, strong folds, the posterior one nearly twice as large as the other, below these folds nearly straight.

"Aperture terminating in a short, open canal. A small umbilicus nearly covered by callus.

"*Locality.*—Matthews' Landing, Ala."

Not having any good specimen of this species we have copied Aldrich's figure.

MAZZALINA.

Mazzalina impressa, Pl. 9, figs. 5, 6.

Syn. *Neptunea impressa* Gabb, Jr. Ac. Nat. Sci., Phila., vol. iv, p. 389, pl. 68, fig. 5.

Gabb's original description.—"Fusiform, whorls six, rounded; spire sharp, but not very high; mouth ovate, canal moderately long, outer lip simple, inner lip coated with a somewhat heavy layer of enamel, a very small sinus between the two lips posteriorly, not an emargination but rather a continuation of the suture, lined with enamel; surface in some specimens nearly smooth, in others closely marked by fine impressed, revolving lines.

"*Dimensions.*—Length .8 in., width of body whorl .5 in., length of mouth .55 in.

"*Locality.*—Hardeman Co., Tenn. Ripley Group."

We herewith figure two of Gabb's types (Safford's collection). They are from a dark, bluish gray, fine, sandy clay, 2 miles south-southeast of Middleton, Tenn.

Mazzalina impressa var. *orientalis*, Pl. 9, fig. 7.

Varietal features.—Whorls more strongly sculptured than those of typical *impressa;* spiral whorls becoming quite nodular towards the apex.

Locality.—GEORGIA: Base of the Midway, Chattahoochee river.

Types.—Paleontological Museum, Cornell Univ.

LEVIFUSUS.

Levifusus pagoda var., Pl. 9, fig. 8.

Syn. *Pleurotoma? pagoda* Heilprin, Proc. U. S. Nat. Mus., 1880, p. 149, pl. , fig. 1.
Fusus pagodeformis Hp., Proc. Ac. Nat. Sci., Phila., 1880, p. 375.
Fusus pagodæformis Hp., *ibid.*, 1890, p. 395.

Heilprin's original description.—"Ventricose; whorls about nine, the body whorl nodulated on the most convex portion (nearly central), the nodulations consisting of a single series of sharp, obtusely pointed, and flattened spines or nodes, which frequently appear double by the crossing of an impressed line over their basal portion; upper volutions with a similar series of nodes almost immediately above the sutural line, and gradually dwindling off into a crenulation, upper surface of the whorls concave, faintly striated, the sinual rugæ indicating but a faint sinus; lower surface with numerous well developed revolving lines, which show a tendency to alternate. Aperture exceeding the spire in length, considerably contracted at about its center.

"Length, 1½ inch.

"Eocene of Alabama."

The generic position of this species has for some time been a matter of perplexity to the writer. Now, however, its generic if not specific identity with Aldrich's *Levifusus suteri* can be proven by our ample collection of *pagoda*-like forms. The Matthews' Landing specimens often have somewhat higher spires than those do from Oak Hill; one of the latter is shown by our figure. At Bell's Landing, the two forms, *suteri* and *pagoda*, both varying somewhat from the Matthews' Landing specimens, are found in the same bed. The Wood's Bluff specimens when young have a decided *Surcula*-like aspect owing to the height of their spires, but when adult the large size of the body whorl gives them a still greater likeness to *Fulgur*-like genera. The many intermediate forms between *suteri* and *pagoda* can be more properly discussed in our next year's work, and hence the matter will be passed over for the present with only this slight notice.

Since our *L. branneri* of the Jackson group is extremely close to *Fulgur*, it is interesting to note how the last mentioned genus may have been derived from *Pleurotoma*. The successive steps would be *Pleurotoma*, *Surcula*, *Levifusus* (*pagoda*-like forms), *Levifusus* (*suteri*-like forms), *Levifusus* (*trabeatus*-like forms), *Levifusus branneri*, *F. echinatum*. Another branch leaves the *pagoda*-like prototype and gives off forms like *L. dalei* and *L. blakei* with but one spinous strong carination.

After writing the above we notice that Dall has called attention to the fact that *Levifusus* is a precursor of *Fulgur*. In this we agree most heartily; in fact our writings of several years ago, but published only last year, (Proc. Ac. Nat. Sci., Phila., 1895, p. 70), plainly state the same fact. We cannot, however, agree with Dall when he ranks *Bulbifusus* as likewise one of the progenitors of *Fulgur*. We have already shown that *Bulbifusus* and *Mazzalina* are synonyms (Ann'l Rep't Geol. Surv. Ark., 1892, p. 165), and hence are Fasciolarioid and not Fulguroid.

The perculiar reversion of many of the *Levifusi* towards *Pleurotoma* is worthy of special notice. Heilprin described *L. pagoda* as a *Pleurotoma;* in the U. S. Nat. Museum we frequently classed it as "*Pleurotomella*." Specimems of a form (*L. trabeatoides*) from Texas, Louisiana and Arkansas, both Dall and myself, before carefully studying them, were inclined to place among the *Pleurotomæ*. Even in the Miocene of St. Mary's, Md., there are Fulgurs with a *Levifusus* or *Surcula*-like aspect. See *F. tuberculatum* and *F. fusiforme*.

Localities (Midway).—ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill P. O.

Type.—U. S. National Museum.

Levifusus suteri, Pl. 9, fig. 9.

Syn. *Levifusus suteri* Ald., Bull. Am. Pal., No. 2, 1895, p. 11, pl. 3, fig. 4.

Aldrich's original description.—"Shell oblong-ovate, whorls seven, the first three smooth, next nodular and angulated. The periphery of each whorl marked by a double spiral line or band carrying nodes where crossed by longitudinal plications; upper part of whorls looking down on same shows a spiral line inside of the peripheral border following the sinuosities of the same; periphery of body whorl spinous and beaded, followed by a broad concave space below, then a second spiral ring, followed by a third space and ring; spiral lines cover the canal; the third spiral ring extending within the aperture; outer lip smooth, aperture quadrate above with a narrowing canal below; columella smooth, curved; canal slightly twisted, umbilicus rudimentary.

"*Locality.*—Matthews' Landing, Ala."

Specimen figured.—1 mi. W. of Oak Hill, Wilcox Co., Ala.

Levifusus trabeatus var., Pl. 9, fig. 10.

Syn. *Fusus trabeatus* Con., Foss. Sh. Tert. Form., Sept., 1833, p. 29; 2d ed., p. 53, pl. 18, fig. 1.
F. bicarinatus Lea, Cont. to Geol., Dec., 1833, p. 146, pl. 5, fig. 147.
Levifusus trabeatus var., Ald., Bull. Am. Pal., No. 2, p. 10, pl. 4, fig. 6.

Conrad's original description.—"Shell subfusiform, ventricose, with revolving elevated striæ at the base and more obscure ones on the spire: body whorl with two distinct rows of tubercles, humeral one continued on the spire. Length 1½ inches.

"*Locality.*—Claiborne, Ala.

"Cab. Acad. N. S."

This, if *trabeatus* at all, is a strongly spinous variety that lacks all traces of the third carina which generally characterizes the genus; the specimen herewith figured is the same specimen shown by fig. 6, pl. 4, of Bull. No. 2. It is from Matthews' Landing and belongs to T. H. Aldrich. A fragment of the same is in our collection from Dale's Branch.

A specimen in Dr. Safford's collection from Middleton, Hardeman Co., Tenn., is very strongly bicarinate but the tubercles are not so large nor so far apart. A small specimen is in our collection from bed *e*, ½ mi. N. of Ripley, showing a great number of denticulations on the upper carina while the lower is smooth.

Levifusus hubbardi n. sp., Pl. 9, fig. 11.

Specific characterization.—General form somewhat more slender than shown in the figure owing to the compressed and broadened condition of the cast from which the figure was drawn; whorls about 7 or 8; spiral whorls marked by (*a*) a prominent median carina bearing a number of slightly flattened spines, (*b*) a more or less prominent spiral line midway between the carina and the suture below; suture with a spiral line; body whorl strongly bicarinate, each carina bearing about 20 slightly flattened spines which affect the surface but little above or below their respective carinas; somewhat below the lower strong carina there is a third, consisting of a narrow, raised, strong line which likewise bears about 20 small spines; still below this faint carina there is a strong revolving line; outer lip angular at points where the carinas inpinge upon it, sharp-edged, thickened within and there lirate; anterior canal somewhat reflexed.

This species differs from all species of this genus heretofore described, by its extremely high spire, the revolving line below the carina of the spiral whorls, and in the structure of the lowest carina on the body whorl, *i. e.*, it is narrow, sharply defined and spine bearing, while in all other known species it is broad, smooth and indefinite. Were the specimen figured not flattened by pressure it would appear much more slender, or *Fusus*-like.

Locality.—MISSISSIPPI: ½ mi. N. of Ripley.

Type.—Paleontological Museum, Cornell Univ.

Levifusus dalei n. sp., Pl. 9, fig. 12.

Specific characterization.—Size and general form as indicated by the figure; whorls about 6; 1 and 2 smooth, 3, 4, 5 with a denticulate carina below the middle of each whorl; body whorl with a humeral carina bearing about 20 compressed denticulations, above with lines of growth prominent and showing a broad yet well defined retral sinus, below with lines of growth fine but visible and distinct; spiral striæ above the carina extremely fine and even, below the same, stronger and alternating in size; pillar long and straight with a thin coating; labrum smooth within.

Fragments of larger specimens show that the carinal spines become long yet very much compressed vertically, with age; the spiral lines below the carina become very pronounced.

The general form of older specimens approaches *Fusus quinquespinus* Dall, though of course there are more than five spines.

Locality.—ALABAMA: Dale's Branch, near Oak Hill P. O., Wilcox Co.

Type.—Paleontological Museum, Cornell Univ.

FULGUR.

Fulgur? dallianum n. sp., Pl. 9, fig. 13.

Specific characterization.—Size and general form as indicated by the figure; spire low, whorls about 5, the humeral angle of each corresponding to the suture or nearly so, faintly tubercular; body whorl bicarinate, the upper carination ornamented with vertically compressed, not prominent, tubercles, the lower carination less prominent and not ornamented; inner lip somewhat calloused and covering the inner margin of the columella and the inner lower portion of the adjacent whorl; lines of growth when leaving the suture not directed radially outwards but bent back at an angle of perhaps 30° from a true radius; in approaching the carina, however, they curve slightly forward, having passed the same they pass nearly vertically downwards though inclining slighly forwards; at the lower carina they are deflected slightly backwards; spiral striation very faint in the specimen figured, though doubtless fine, even, and everywhere present on well preserved specimens.

Locality.—This specimen (the only one known) belongs to the collection of the U. S. Nat. Museum and is marked "264a, Wilcox Co., Ala., L. C. Johnson," collector. The nature of the matrix in which this specimen was embedded renders it safe to say that it came from bed 18, sect. p. 31, a mile or two south or southwest of Palmer's mill.

NEPTUNEA.

Neptunea constricta, Pl. 9, fig. 14.

Syn. *N. constricta* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 24, pl. 5, fig. 13.
N. matthewensis Ald., *idem.*, p. 59.

Aldrich's original description.—"Shell broadly fusiform, whorls eight, spire high; suture distinct, whorls concave and compressed just below the suture; covered at this point with fine transverse lines, remaining space smooth. Body whorl large, smooth below the the above-mentioned sutural area, narrowed below into a short, stout canal which is marked by fine revolving lines. Aperture about two-thirds the length of the shell; outer lip sharp, thickened and crenulate within; inner lip concave above, straight below; callus not heavy.

"*Locality.*—Matthews' Landing, Ala."

Our specimens from this locality are fragmentary, hence I have copied Aldrich's figure. An imperfect cast from bed *b* at Hannah's, near Crainesville, Tenn., is quite probably of this species.

Several of our specimens indicate a size considerably greater than the figure.

LEVIBUCCINUM.

Levibuccinum lineatum, Pl. 9, fig. 15.

Syn. *L. lineatum* Heilp., Proc. Ac. Nat. Sci., Phila., 1880, p. 371, pl. 20, fig. 5.
L. lineatum Ald., Geol. Surv. Ala., Bull. 1, 1886, p. 59.

Heilprin's original description.—"Shell fusiform, of about seven convex volutions, which are throughout their whole extent covered by fine, but distinct, revolving lines; aperture slightly exceeding the spire in length, sub-canaliculate anteriorly; columella gently arcuate; outer lip striate within.

"Length, 1 inch. Knight's Branch, Clarke Co., Ala.

"This species mainly differs from *L. prorsum* Con. in having the revolving lines equally distant over the entire surface of the whorls."

This species is typically developed in the Lignitic of Alabama, but a few specimens have been found in the Midway. Aldrich's specimen was from Matthews' Landing; ours are from Black Bluff and 1 mile west of Oak Hill P. O. A fragmentary specimen from the latter locality is shown by the figure.

PSEUDOLIVA.

Pseudoliva unicarinata, Pl. 9, fig. 16.

Syn. *P. unicarinata* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 19, pl. 5, fig. 17.

Aldrich's original description.—"Shell broadly ovate, whorls seven, sutural line wavy; spine [spire] sharp, the upper part rising suddenly from the flattened body whorl; nucleus composed of three smooth embryonic whorls. Body whorl shouldered, bearing large longitudinal ribs pointed at the angle, extending nearly to the sulcus below; above reaching to the suture, where they abruptly turn to the left and form rather deep pits between them. The carina of the body whorl has a raised line connecting the pointed part of the tuberculations; all the whorls below the nucleus show the tuberculations; sulcus rather deep. No umbilicus; entire surface covered with very fine revolving lines.

"*Locality.*—Matthews' Landing, Ala.

"Nearest to *Pseudoliva tuberculifera* Con.; but that species has strong revolving lines; its tubercles are lower down on the body whorl, not sharp; the sutural part is entirely different, and the shell is besides much more fusiform."

It seems as though Aldrich must have had a specimen of *P. scalina* before him when he wrote "spire sharp, the upper part rising suddenly from the flattened body whorl." Otherwise the description fits the figure.

Localities.—ALABAMA: Naheola; Matthews' Landing; 1 mi. W. of Oak Hill.

Type.—Collection of T. H. Aldrich.

Specimen figured.—Lea Memorial collection, Ac. Nat. Sci., Phila.

Pseudoliva ostrarupis, Pl. 9, figs. 18, 19.

Syn. *P. ostrarupis* Harris, Proc. Ac. Nat. Sci., Phila., 1895, p. 75, pl. 8, figs. 3, a.

Harris' original description.—"Size and general form as figured; volutions 6, spiral whorls shouldered and somewhat costate; suture obscured by foliæ developed by the intermittent mode of growth of the sutural callosity; body whorl below scarcely distinguishable from the non-umbilicate varieties of *P. vetusta*, while above, the shoulder and the sutural foliæ at once definitely characterize the species.

"*Locality.*—Smiley's Bluff, Brazos river, 2 miles above the mouth of Pond creek, Milam Co., Tex.

"*Geological horizon.*—Midway Eocene.

"*Type and specimen figured.*—Texas State Museum."

Pseudoliva ostrarupis var. *pauper*, Pl. 9, fig. 20.

Syn. *Pseudoliva ostrarupis* var. *pauper* Harris, Proc. Ac. Nat. Sci., Phila., 1895, p. 76, pl. 8, fig. 4.

Harris' characterization.—Figured without description.

Locality.—Smiley's Bluff, Brazos river, 2 miles above the mouth of Pond creek, Milam Co., Tex.

Geological horizon.—Midway Eocene.

Type.—Texas State Museum.

Pseudoliva vetusta, Pl. 9, fig. 17.

Syn. *Monoceros vetusta* Con., Foss. Sh. Tert. Form., 1833, p. 44, and p. 37, pl. 15, fig. 3, of 2d ed., 1835.

Conrad's original description.—"Subglobose, with revolving striæ, obscure, except the base, where they are distinct, spire short, rapidly narrowing to the apex, which is acute; tooth short and robust, placed at the termination of an exterior groove; basal margin profound; labrum acute on the margin."

The specimen so described was from Claiborne, Ala. It is known in nearly every horizon in our Eocene series.

The Midway specimens we obtained are all fragmentary, but several show clearly the characters of the species.

Localities.—ALABAMA: Matthews' Landing; Dale's Branch; 1 mi. W. of Oak Hill.

Type.—Ac. Nat. Sci., Phila.

Pseudoliva scalina, Pl. 9, fig. 21.

Syn. *P. scalina* Heilprin, Proc. Ac. Nat. Sci., Phila., 1880, p. 371, pl. 20, fig. 12.
P. scalina Ald., Geol. Surv. Ala., Bull. No. 1, 1886, p. 20, pl. 6, fig. 10.
? *Harpa dechordata* White, Arch. do Museu Nac. do Rio de Janeiro, p. 136, pl. 13, figs. 7, 8.

Heilprin's original description.—"Shell bucciniform, of about seven volutions; the whorls roughly plicated; the folds on the body whorl appearing as shoulder nodules; dentiferous sulcus well pronounced, followed by about five impressed revolving lines, which slightly crenulate the margin of the outer lip; revolving lines on the body whorl above the sulcus almost obsolete; aperture slightly exceeding the spire in length; columella callous; suture deeply channeled.

"Length, 1½ inch. Wood's Bluff, Clarke Co., Ala."

Localities (Midway).—ALABAMA: ⅓ mi. N. of Prairie Bluff; Matthews' Landing; ½ mi. W. of Graveyard hill; 1½ mi. S. W. of Palmer's mill; 1⅓ mi. N. E. of Clayton.

Pseudoliva sp., Pl. 9, fig. 22.

In the material collected from the railroad cut, 1⅓ mi. N. E. of Clayton, there is an imprint of a *Pseudoliva* showing the features represented by fig. 22, *i. e.*, a very pointed spire, minute or not strong nodes on the shoulder of the body whorl, a strong spiral channel rather high up on the body whorl and traces of spiral lines below. The vertical lines and the spiral lines on the shoulder are lines of shading only, the original specimen is of too coarse material to show such markings. More material must be collected before we can decide certainly whether this is or is not a variety of *P. tuberculifera* Con. On first sight it appears very distinct, but when the great variations of *P. vetusta* are borne in mind one becomes cautious in proposing new specific names. The figure is natural size.

TROPHON.

Trophon morulus, Pl. 10, fig. 1.

Syn. *Murex morulus* Con., Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 293, pl. 47, fig. 28.

Conrad's original description.—"Fusiform; whorls angular, with distant spines on the angle, two or three of which are produced; ribs longitudinal, oblique, foliated, acute; angle of body whorl situated about the middle of the shell; beak sinuous, angle of aperture extending into an elongated, recurved spine.

"Length ⅝ inch."

Localities (Midway).—ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill P. O.

Type.—Ac. Nat. Sci., Phila.

MUREX.

Murex (*Pteronotus*) *matthewsensis*, Pl. 10, fig. 2.

Syn. *M. matthewsensis* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 18, pl. 3, fig. 15.

Aldrich's original description.—"Shell triangular, whorls probably four; angular, smooth between the varices; varices three, longitudinal, prominent; spines of the body whorl elongated and curved upward, the one at the angle of the aperture nearly closed; body whorl angulated on upper part, the other whorls rounded; aperture ovate, outer lip thick with a foliation at the junction with the body whorl running from the spine to the beak; inner lip smooth with a slight lamina; beak short; canal rather wide.

"*Locality.*—Matthews' Landing, Ala.

"Differs from *M. morulus* Con., in having no spines between the varices at the shoulder of the body whorl, and has no crenulations on the edge of the outer lip."

Localities.—ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill P. O.

Type.—Aldrich's collection.

TRITON.

Triton (*Ranularia*) *eocensis*, Pl. 10, fig. 3.

Syn. *Fulgur eocense* Ald., Bull. Am. Pal., No. 2, p. 10, pl. 3, figs. 7, 7a.

Aldrich's original description.—"Shell oblong fusiform; spire obtuse; whorls seven, angulated; whorls of the spire four in number and smooth, the others covered with fine revolving striæ; periphery of the last three whorls bounded by longitudinal tubercles, sometimes a double line of these appearing upon the upper whorls; body whorl with three strong carinæ, the one on the shoulder strongly tuberculose; one varix showing in all the specimens; suture impressed, linear; outer lip internally denticulated and thickened; inner lip bearing a fold near base of aperture; canal long, nearly straight, slightly tortuous, bent upwards, finely striated to the extremity.

"*Localities.*—Matthews' and Gregg's Landings, Ala."

That this belongs to the Tritons is shown by a specimen in the writer's private collection from Gregg's Landing, better preserved about its aperture than any figured by Aldrich.

This species reminds one somewhat of *Rhinocantha* and *Haustellum* among the *Muricidæ*, but its agreement with certain species of the living *Ranularia*, *i. e.*, *Gutturnium* Klein, is closer still.

Localities (Midway).—ALABAMA: Matthews' Landing; Dale's Branch.

Type.—Aldrich's collection.

Triton (*Simpulum*) *showalteri*, Pl. 10, fig. 4.

Syn. *Simpulum showalteri* Con., Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 292, pl. 47, fig. 11.
Triton showalteri Ald., Geol. Surv. Ala., Bull. No. 1, 1886, p. 59.

Conrad's original description.—"Fusiform; whorls eight, angular, periphery of angle acute, situated below the middle of the whorl; whorls of spire costate longitudinally, but not very distinctly; revolving lines closely arranged, fine, with a few distant, prominent lines; three first whorls of the spire smooth, the next two tuberculated; angle tuberculated; a prominent, acute line on the body whorl runs from the upper extremity of the aperture, and a similar finer line between it and the angle above; columella rugose, with a prominent fold near its upper end; labrum dentate within.

"Length 1⅜ inches."

Conrad gives no definite locality for this specimen. He makes the general remark that this and other shells described in the same article are "from a locality farther north in Alabama than Mr. Tuomey had explored."

Locality.—ALABAMA: Matthews' Landing.

Type.—Ac. Nat. Sci., Phila.

PYRULA.

Pyrula juvenis, Pl. 10, figs. 5, 6.

Syn. *P. juvenis* Whitf., Am. Jr. Conch., vol. i, 1865, p. 259.

P. multangulata Heilp., Proc. Ac. Nat. Sci., Phila., 1886, p. 374, pl. 20, fig. 2.
? *P. tricostata* Heilp., *non* Desh., *ibid.*, p. 374, pl. 20, fig. 6.
P. juvenis Ald., Geol. Surv. Ala., 1886, p. 25, pl. 6, fig. 8.
Pyrula sp., Har., Geol. Surv. Ark., vol. ii, 1890, p. 46, pl. 3, fig. 3.

Whitfield's original description.—"Shell small and fragile; spire elevated; columella slender, slightly bent; aperture large, elongate, ovate or subelliptical; volutions three, marked on the periphery by three distinct carinæ or subangular revolving ridges, the upper one marked with closely arranged longitudinally elongate nodes, the others simple; entire surface marked by very fine revolving lines, which are somewhat fasciculate below the lower carina, there being three finer ones between each large one.

"*Dimensions.*—Length .6 inch, transverse diameter a little less than .3 inch.

"*Locality.*—Six miles above Claiborne, Alabama, west side of river."

This species is remarkable for its variability. Two forms are shown by the figures. Whitfield's specimen had but three carinas, while the Midway specimens often have four and a trace of a fifth; one or two of the apical whorls smooth, the third passing from obliquely costate to bicarinate, the fourth strongly bicarinate, the carinas crenulate. Obscure oblique ribbing is often seen connecting the nodes on the two carinas.

Localities—ARKANSAS: Near Olsen's switch, a few miles S. W. of Little Rock. See Ann'l Rep't Geol. Surv. Ark., vol. ii, pl. 3, fig. 3.
ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill; ½ mi. W. of Graveyard hill.

CYPRÆA.

Cypræa sp.

We have encountered two species of this genus in the Midway stage. One, a small, smooth species like the Jackson specimens was found ½ mile north of Ripley, Miss. The other, a small, reticulated species like *C. lintea* Con., was obtained from the uppermost Midway limestone as it crops out at Ft. Gaines, on the Chattahoochee. Neither are sufficiently well preserved to merit figuring or further description.

*CALYPTRAPHORUS.**

Calyptraphorus velatus var. *compressa*, Pl. 10, figs. 7, a, b, 8.

Syn. *Anchura* White, U. S. Geol. Surv., Bull. No. 4, 1884, p. 17.
Rostellaria velata Ald., Geol. Surv. Ala., Bull. No. 1, 1886, p. 59.
Rostellaria Smith and Johnson, U. S. Geol. Surv., Bull. No. 43, 1887, p. 66.
Calyptraphorus velatus Harris, Geol. Surv. Ark., vol. ii, 1892, p. 46.
Rostellaria (*C.*) *velatus* var. *compressa* Ald., Geol. Surv. Ala., 1894, p. 244, pl. 12, figs. 2, 2a, 2b.

Aldrich's characterization of this variety.—"This form is intermediate between *R. trinodifera* Con. and *R. velata* Con. The adult has the enamel on the front part as in *R. trinodifera*, but on the opposite side the line of demarkation of the enamel comes down only to the [body] whorl. The specimens are also much smaller than the normal adult. A similar form that cannot be separated from this variety is common in the Matthews' Landing group but is nearly twice as large, more rotund than those figured. The figures given are somewhat larger than the type."

The smaller type of this variety is common in the lower and medial Midway beds. It is one of the first to appear above the Eocene–Cretaceous contact line. The larger specimens differ from *Calyptraphorus velatus* from the Claiborne sand mainly by the pointed exterior-posterior termination of the labrum; in *velatus* this portion of the labrum is rounded, as shown by figure 5, plate 15, of Conrad's Fossil Shells, etc., 1835.

Localities.—TEXAS: Brazos river, at and near the Cretaceous–Eocene contact.
ARKANSAS: Near Olsen's switch, a few miles S. W. of Little Rock.
TENNESSEE: Hannah's, 1¾ mi. N. or N. E. of Crainesville; ½ mi. W. of Hannah's; Huddleston's; Middleton.
MISSISSIPPI: ½ mi. N. of Ripley; 1 mi. E. of Ripley; ½ mi. S. of Ripley C. H.

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* Fischer in his *Manuel de Conchyliologie*, p, 672, has emended the orthography of this word so that it reads *Calyptrophorus*. Although we used the emended form of the word in the geological part of this work, we do not hesitate, on further consideration of the subject, to return to Conrad's original spelling.

ALABAMA: Naheola; Matthews' Landing; 1 mi. N. of Midway; 2 mi. N. of Snow Hill; Josh Hunter's; Dale's Branch; ½ mi. W. of Graveyard hill; 2 mi. W. of Oak Hill; 1½ mi. S. W. of Palmer's mill, on McConnico's plantation; at Palmer's mill, see frontispiece; Cole's place, 1 mi. W. of Palmer's mill; 1 mi. S. W. of Clayton; 1⅓ mi. N. E. of Clayton.

GEORGIA: Base of Midway, Chattahoochee river; not far above the mouth of Sandy creek, Chattahoochee river.

APORRHAIS.

Aporrhais sp., Pl. 10, fig. 9.

We have as yet obtained no really good specimens of this genus in the Midway. The figure represents an imperfect specimen obtained from near the southeast line of Hogan's Survey, Falls county, on the west bank of the Brazos. It is quite probably *A. gracilis* Aldrich, since that author lists it from Black Bluff, Ala. Similar specimens were found by the writer near Tehuacana, Texas, about 50 feet below the Midway limestone ledges. A cast in our last summer's collection is from 1 mile north of Midway; it is with little doubt *A. gracilis.*

CERITHIUM.

Cerithium (*Companile*) *claytonense*, Pl. 10, figs. 10, 11.

Syn. *C. claytonense* Ald., Geol. Surv. Ala., 1894, p. 246, pl. 13, figs. 1, a, b.

Aldrich's original description.—"Shell large, rapidly tapering, whorl remaining, thirteen, each banded by a broad nodulous raised space alternating with four or five deeply cut spiral lines, sometimes showing a fine raised line in the depressions, columella showing internally two plications between the whorls.

"No perfect specimens yet found but the species is very distinct and much larger than hitherto known from our Eocene. Length of largest specimen 125 mm. Specimen showing internal structure from the National Museum; the other from the State Survey collection."

The locality whence these large specimens were derived was doubtless McConnico's plantation, 1½ mi. S. W. of Palmer's mill. Mr. Stonewall McConnico very generously gave us a specimen nearly equal in size to that shown on plate 10, figure 11.

It shows that between the three spiral lines of each whorl there are sometimes as many more, somewhat less conspicuous, still very evident. Another specimen shows the columellar plaits as in fig. 10, pl. 10; they are, however, somewhat more acute. On the base of each whorl there is a strong, median spiral ridge.

A fragment of a large whorl presumably of this species was found in the uppermost bed of the Midway limestone as exposed on Chattahoochee river at Ft. Gaines.

Cerithium gainesensis n. sp., Pl. 11, fig. 1.

Specific characterization.—Size and general form as indicated by the figure; whorls about 13; 1 to 10 with 15 to 25 low ribs nearly equal to the interspaces, crossed by three strong, subequal, primary spirals, between which there are in well preserved specimens thread-like lines of secondary order; sometimes granular at junction of the ribs and primary spirals; sides of whorls nearly regularly convex but with a tendency to become slightly constricted for a little distance below the suture, then gradually rounding in the middle and slightly gibbous below, the variation from a circular curve, however, is very slight; the whorls 11 and 12 are but slightly ornamented, generally with a varix or two and with a few slight indications of ribs and with three or four faint spirals; the middle one is sometimes on a very slight carination; body whorl with generally one varix, with anterior and posterior canal, and with outer lip sharp on the edge but thickening rapidly within.

In some specimens there are four primary spirals on each whorl.

Dall has described a fragment of a spire of a *Cerithium* from Jacksonboro, Ga., under the name of *C. platynema*. At first I was inclined to think that fragment might possibly be *gainesensis*, for the ribbing and three strong spirals with finer lines seemed to agree very well with Dall's species; but I fail to find any trace of the broad plain spiral at the base of each lower whorl as is noted in both Dall's figure and description. Mr. Hubbard and I collected a large number of specimens of *gainesensis*, and although all are in the forms of moulds and casts, gutta-percha impressions of them show every portion of the species many times. Common.

Locality.—GEORGIA: Uppermost Midway as exposed on the Chattahoochee at Ft. Gaines.

Type.—Paleontological Museum, Cornell Univ.

Cerithium globoleve n. sp., Pl. 11, fig. 2.

Specific characterization.—Size and general form as indicated by the figure; whorls about 12, increasing in size regularly from the apex, the penultimate the largest; surface smooth, lines of growth scarcely perceptible, slightly recurved centrally; suture distinct but not deep; body whorl slightly compressed centrally with a few inconspicuous spiral lines at base crossed by lines of growth; anterior canal short, decurved; posterior margin of the mouth showing a small posterior canal.

The figure is of a gutta-percha impression, and does not show the canal as does the mould from which the impression was made. Other specimens also show the deflected anterior canal and traces of the posterior.

Locality.—ALABAMA: Common in the R. R. cut, 1⅓ mi. N. E. of Clayton.

Type.—Paleontological Museum, Cornell Univ.

Cerithium mediaviæ n. sp., Pl. 11, figs. 3, a.

Specific characterization.—Size and general form as shown by the figures; whorls 10-12, marked by costæ nearly equal in width to the interspaces, about 15 on the penultimate whorl, not so many above; suture sharply defined; each whorl with five or six sharp, raised, spiral lines between which as many more finer ones often appear; body whorl with costæ becoming obsolete below the middle, anterior canal short and deflected, posterior margin of the mouth calloused and grooved, forming a posterior canal.

It seems a pity that this *Cerithium* so characteristic of the limestone ledges N. E. of Clayton could not be called *claytonense*, but this name is already preoccupied by the large species from Wilcox Co. and which unfortunately is unknown at Clayton.

Locality.—ALABAMA: In the light yellowish limestone ledges in a R. R. cut, 1⅓ mi. N. E. of Clayton.

Type.—Paleontological Museum, Cornell Univ.

Cerithium penrosei, Pl. 11, fig. 4.

Syn.—*C. penrosei*—Proc. Ac. Nat. Sci., Phila., 1895, p. 79, pl. 9, fig. 4.

Harris' original description.—"Whorls at least 15, gradually tapering, ornamented as follows: by (1) about seven laterally compressed, oblique subcentral or basal nodes, or costæ on each whorl, those on the smaller whorls of the spire not so distinctly defined as represented by the figure; by (2) spiral lines or striæ, about five of which are strong and occupy the lower one-third of each whorl, three or four more are finer and occupy a narrow, irregular, central zone, while four or five more occupy the upper or non-costate portion of the whorls. The costæ on the several whorls are arranged in lines corresponding in direction to the obliquity of the costæ.

Unfortunately only fragments of this large *Cerithium* have been found; it doubtless measured eight or ten inches in length when entire.

"*Locality.*—Smiley's Bluff, Brazos river, 2 miles above the mouth of Pond creek, Milam Co., Texas.

"*Geological horizon.*—Midway Eocene.

"*Type.*—Texas State Museum."

TURRITELLA.

Turritella tennesseensis. Pl. 11, fig. 5.

Syn. *T. tennesseensis* Gb., Jr. Ac. Nat. Sci., Phila., vol. iv., 1860, p. 392, pl. 68, fig. 13.

Gabb's original description.—"Turrited, spire high; whorls? (10?) flattened or concave on the side, carinated strongly below; mouth subquadrate; surface marked by numerous revolving striæ, two or three of which are generally larger than the rest, the remainder usually alternating, one or two small ones with one slightly larger.

"Length (restored)?, 1.2 in.?, width of body whorl one inch from apex, .35 in.

"*Locality.*—Hardeman Co., Tenn., marls of Ripley Group. Prof. Safford."

We have all of Gabb's specimens before us. Two small ones are doubtless the young of *T. mortoni;* and the others should be placed in the same section, if not under the same specific name. Fig. 5 shows the characters of this so-called species. It will be noticed that the line some distance below the suture is more pronounced than in fig. 6, *T. alabamiensis*, and that the basal carination is somewhat more noticeable. This as well as the following three species? are quite probably but variations of *T. mortoni.*

Localities.—TENNESSEE: R. R. cut, 2 mi. E. of Middleton, (the specimen figured); 2 mi. S. of Middleton.
GEORGIA: Near base of Midway, Chattahoochee river.

Type.—Collection of Dr. Safford, Vanderbilt Univ., Tenn.

Turritella alabamiensis, Pl. 11, fig. 6.

Syn. *T. alabamiensis* Whitf., Am. Jr. Conch., 1, 1865, p. 267.
T. alabamensis Ald., Geol. Surv. Ala., 1894, p. 246, pl. 13, fig. 2.

Whitfield's original description.—"Shell slender; volutions twelve or more; subquadrangular, lower margin sometimes projecting; suture distinctly marked; aperture subelliptical, slightly oblique; surface marked by numerous fine revolving lines, which are scarcely alternate, and crossed by distinct lines of growth, which make a deep sinus on the body of the volution, and are again bent backwards on the lower angle.

"This species scarcely differs from *T. cœlata* Conrad, from the Vicksburg (Miss.) beds, except that it is destitute of the lines of granules which give so decided a character to that species.

"*Locality.*—Nine miles below Prairie Bluff, Alabama.

The figure given herewith is the same as that shown on plate 13 of Aldrich's work referred to above. It is of the same general shape as the typical specimens from Matthews' Landing, but lacks the sharp spiral and longitudinal sculpturing of the latter. We are inclined to regard this species as but a marked variety of *T. mortoni*.

Localities.—TEXAS: Brazos river, not far from the Cretaceous–Eocene contact.
ARKANSAS: Near Olsen's switch, a few miles S. W. of Little Rock.
ALABAMA: Matthews' Landing; 1½ mi. S. W. of Palmer's mill; Dale's Branch; 1 mi. W. of Oak Hill; ½ mi. W. of Graveyard hill.

Type.—Hall collection.

Turritella saffordi, Pl. 11, fig. 7.

Syn. *T. saffordi* Gabb, Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 392, pl. 68, fig. 12.

Gabb's original description.—"Scalariform; whorls eight or ten, somewhat carinated below, flattened on the side; suture profound; mouth subquadrate; surface marked by three small revolving lines on the lower portion of the whorl, near the suture, and on some specimens by obscure revolving lines near [on] the whole whorl, always crossed by waved lines of growth.

"*Dimensions.*—Length (restored) 2.2 in., width of body whorl .6 in., length of mouth .4 in.

"*Locality.*—Hardeman Co., Tenn. Prof. Safford. From the light grey limestone alternating with the marls of the Ripley Group."

This species? is only another form that can be traced directly into *T. mortoni.* Larger specimens occur in great abundance in the so-called Turritella rock of Tippah Co., Miss., especially ½ mile south and two miles east of Ripley. A larger specimen of a slightly different form is shown by fig. 8, pl. 11. This was obtained from the Midway limestone, 1¾ miles N. E. of Bradford station, Ark.

Type of this (species?).—Collection of Jas. M. Safford. One of these type specimens is shown by fig. 7.

Turritella mortoni var. *levicunea* n. var., Pl. 11, fig. 9.

This variety differs from typical *T. mortoni* by its greater apical angle, its finer striation and the lack of a strong subcentral carina on the whorls.

Localities.—ALABAMA: Matthews' Landing; Dale's Branch.
GEORGIA: Ft. Gaines.

Type of variety.—Paleontological Museum, Cornell Univ.

Turritella mortoni Con. is doubtless represented by the foregoing so-called species (figs. 5-8), but it also occurs in the form of casts in great abundance, large size and of most typical form in a soft layer in the Midway limestone near its base along the Chattahoochee river.

Other Midway localities whence more or less typical forms have been obtained are:—

TEXAS: 4 mi. N. of Kemp, Kaufman Co.
ARKANSAS: Sect. 9, 1 S., 14 W.; near Olsen's switch; Johnson's well, Little Rock.
TENNESSEE: Hannah's, 1¾ mi. N. E. of Crainesville; Middleton.
MISSISSIPPI: ½ mi. N. of Ripley.
ALABAMA: At and near the Cretaceous–Eocene contact line in many localities about Prairie Bluff; 1 mi. N. of Midway; ½ & 2 mi. N. of Snow Hill; Palmer's mill; 1½ mi. S. W. of Palmer's mill.

Turritella humerosa, Pl. 11, figs. 10?, 11, 12, 13.

Syn. *T. humerosa* Con., Trans. Geol. Soc., Penn., vol. i, 1835, p. 340, pl. 13, fig. 3.
T. eurynome Whitf., Am. Jr. Conch., vol. i, 1865, p. 266.
T. multilira Whitf., *ibid.*, p. 266.
T. bellifera Ald., Geol. Surv. Ala., 1886, Bull. No. 1, p. 34, pl. 1, fig. 13.

T. cathedralis var. *bellifera* De Greg., Mon. Faun. Eoc. Ala., 1890, p. 127, pl. 11, figs. 17 & 38.

Conrad's original description.—"Shell turrited, subulate; whorls with fine regular revolving striæ; an obtuse slight elevation on the summit, a shallow groove at base of each.

"From the Eocene of Piscataway, Maryland."

Though this species is most typically represented in the Lignitic of Alabama, Virginia and Maryland, it occurs very abundantly in nearly all horizons of the Midway and displays a remarkable variety of forms.

Fig. 10 is of doubtful reference to this species and is the figure termed by Aldrich *T. humerosa* var. *multilira*, Geol. Surv. Ala., 1894, p. 246, pl. 13, fig. 3. Fig. 11 is more nearly typical *humerosa*, it is also after Aldrich. Fig. 12 is a large form belonging to the U. S. National Museum, marked "No. 204, Prairie Creek." It is doubtless from near Oak Hill, bed 9 of section p. 31. Fig. 13 is a very strongly lirate variety from Horn hill, Limestone Co., Tex.

Localities (Midway).—TEXAS: Horn hill; Tehuacana.
ARKANSAS: Near Olsen's switch, a few miles S. W. of Little Rock.
ALABAMA: Matthews' Landing; 2 mi. N. of Snow Hill; 1⅓ mi. N. E. of Clayton.

Turritella nerinexa, Pl. 11, fig. 14.

Syn. *T. nerinexa* Harris, Proc. Ac. Nat. Sci., Phila., 1895, p. 82, pl. 9, fig. 9.

Harris' original description.—"Size and general form of a fragment (the only known specimen) as indicated by the figure; number of whorls unknown, ornamented by (1) fine, even, spiral striæ, (2) a subsutural row of pustules or crenules, and (3) a slightly raised or faint ridge at the base of each whorl becoming obsolete in the lower whorls, but increasing in strength above so as to nearly equal in size the subsutural line of crenules.

"*Locality.*—Black Bluff, Brazos river, extreme northern limit of Milam Co., Milam Bluff of Penrose's Report.

"*Geological horizon.*—Midway Eocene.

"*Type.*—Texas State Museum."

This species has much in common with *Nerinæa buarquiana* White from the Midway of Maria Farinha. A large specimen of a similar species was found in Eastern Brazil.

Locality.—ALABAMA: ⅓ mi. N. W. of Prairie Bluff.

MESALIA.

Mesalia pumila, Pl. 11, fig. 15.

Syn. *Turritella pumila* Gabb, Jr. Ac. Nat. Sci., Phila., vol. iv, 1860, p. 392, pl. 68, fig. 14.

Gabb's original description.—"Turrited, whorls? (spire is broken) rounded and strongly striate; mouth round; shell very thick; surface marked by three heavy revolving lines on the convexity of the whorl, and one at the base just above the suture, which is small but distinct.

"*Dimensions.*—Length of fragment .5 in., width of body whorl .3 in., diameter of mouth .1 in.

"*Locality.*—With the above. Prof. Safford."

There is little doubt in the writer's mind that if enough material were at hand this would grade into "*Potamides*" *alabamiensis* Whitf.

By examining Gabb's types of this species it will be seen that the one he had most in mind and the one he figured is from a clay bank two miles south of Middleton, associated accordingly with his *Turritella hardemanensis*. The other specimens, see fig. 18, are from the limestone on Muddy creek, east of Middleton.

The specimens from the limestone beds classified by Gabb as *pumila* but certainly more nearly *hardemanensis* are from:—

TENNESSEE: Muddy creek, E. of Middleton; ½ mi. S. of Middleton; 2 mi. E. of Middleton.

Type.—Collection of Dr. Safford.

Mesalia pumila var. *wilcoxiana*, Pl. 11, figs. 16, 17.

Syn. *Turritella wilcoxiana* Ald., Geol. Surv. Ala., 1894, p. 247, pl. 13, fig. 4b.

This was described by Aldrich as a species of *Turritella* from the Midway of Alabama. Since it comes from the same stage as *M. pumila* and bears to it so close a resemblance we have little hesitation in calling all one and the same species with but varietal differences.

Localities.—TEXAS: 1 mi. up Salt branch of Little Brazos river; Tehuacana.

ALABAMA: 1 mi. S., 1½ mi. S. W., and 1 mi. W. of Palmer's mill; 1 mi. N. of Midway.

Type.—Aldrich's collection.

Mesalia pumila var. *hardemanensis*, Pl. 11, fig. 19.

Syn. *Turritella hardemanensis* Gabb, Jr. Ac. Nat. Sci., Phila., 1860, p. 392, pl. 68, fig. 15.

We have figured one type specimen which belongs to Dr. Safford's collection. It is labelled as coming from 2 miles south of Middleton, Tenn. Of the three type specimens all are young or small and hence do not show well the characters of the species. An older specimen is shown by fig. 18. This was found in with *T. pumila* as labelled by Gabb or Safford.

Localities of this variety.—TEXAS: Kemp, Kaufman Co.
ARKANSAS: Johnson's well, Little Rock; Olsen's switch, a few miles S. W. of Little Rock.
TENNESSEE: Muddy creek, E. of Middleton.
MISSISSIPPI: 2 mi. E. of Ripley.
GEORGIA: Base of Midway, Chattahoochee river.

Mesalia pumila var. *allentonensis*, Pl. 11, figs. 20, 21.

Syn. *Turritella allentonensis* Ald., Geol. Surv. Ala., 1894, p. 246, pl. 13, fig. 4a & 6.

This form as shown by the figures seems to us to be simply one of the *pumilæ*. The gradations from one into all the other varieties seem quite complete.

Locality.—ALABAMA: On or near McConnico's plantion, 1½ mi. S. W. of Palmer's mill.

Aldrich's collection.

Mesalia alabamiensis, Pl. 12, fig. 1.

Syn. *Potamides alabamiensis* Whitf., Am. Jr. Conch., vol. i, 1865, p. 266, pl. 27, fig. 13.

Whitfield's original description.—"Shell turrited, consisting of about eight short, strong, rounded volutions; columella short; aperture obliquely ovate, lower basal portion auger-shaped; entire surface marked by strong, sharply elevated, revolving lines, strongest on the middle of the volution; eleven can be counted on the body whorl; the revolving lines are crossed by faint lines of growth, which have a slight sigmoidal curve.

"*Dimensions.*—Length of shell 1.12 inches, transverse diameter of body whorl .45 inch.

"*Locality.*—Six miles below Prairie Bluff, Alabama."

This is evidently the descendant of, or perhaps is identical with, *M. pumila* Gabb. In the lower Lignitic of Alabama it shows a vast amount of variation. The specimens herewith referred to this species are of nearly typical form, but are small.

Locality.—ALABAMA: ½ mi. W. of Graveyard hill.

Type.—Hall collection.

Mesalia watsonensis n. sp., Pl. 12, fig. 2.

Specific characterization.—Size and general form as indicated by the figure; whorls about 10, each marked by three strong, spiral lines, the two upper not so strong as the lower which forms a distinct carina at the base of each whorl; suture profoundly impressed; lines of growth varying in size, passing downward and backward over the upper two spiral lines, then turning downwards, and after crossing the lower carinal line, passing again slightly to the rear; irregularity of the spiral lines causing a slight ribbing with faint nodules on the stronger spiral lines; on the base of the body whorl there are three additional strong spiral raised lines.

Locality.—ALABAMA: Common in the light yellow limestone ledges in the R. R. cut, 2 mi. N. E. of Clayton, Barbour Co.

Type.—Paleontological Museum, Cornell Univ.

Mesalia?, Pl. 12, fig. 3.

This peculiar little specimen was found at Matthews' Landing, Ala. It is certainly too imperfect for full characterization.

Impressions of a very similar or identical species occur in the lowest Midway layer (Turritella rock), 2 miles east of Ripley, Miss., and at the same horizon on Chattahoochee river, Ga.

SOLARIUM.

Solarium alabamense, Pl. 12, fig. 4.

Syn. *S. alabamense* Dall, Trans. Wag. Fr. Inst. Sci., vol. iii, p. 324, pl. 22, fig. 11.

Dall's original description.—"Shell with two and a half whorls besides the nucleus; umbilicus shaped like that of *Patulaxis* with no rib but, as well as the rest of the surface, finely regularly spirally threaded, the threads delicately reticulated by arcuate lines of growth; form depressed, the umbilical carina simple, the upper surface of the whorls somewhat rounded, but bordered by a double, elevated thread, while the periphery (including the lateral aspect of this thread) has a vertical surface, like the tire of a wheel, which offers three strong, elevated, rounded threads with two fine intercalary elevated lines. Alt. of shell 2.0; max. diam. 5.3 mm."

This was described from Matthews' Landing, Ala. Our specimen is from 1 mile west of Oak Hill.

Type.—U. S. National Museum.

Solarium periscelidum, Pl. 12, fig. 5.

Syn. *S. periscelidum* Dall, Trans. Wag. Fr. Inst. Sci., vol .iii, 1893, p. 325, pl. 22, fig. 11.

Dall's original description.—"Shell depressed, rather small, with four or more post-nuclear whorls; periphery with a rather strong annulate rib with a fainter one on each side, the one behind separated by a well-marked, sometimes excavated, interspace; suture appressed, with a granular line in front of it and often several feebler rows in front of that, the surface of this part of the whorl somewhat concave or flattish; base rounded from the keel to the umbilical carina, which is nodular, with or without a few broken fine spirals outside of it, crossed by weakening radial wrinkles; umbilicus rather wide, with a small, well-marked, annulate umbilical rib, and the walls transversely wrinkled and somewhat concave. Alt. 4.2; max. diam. 9.0 mm."

Localities.—ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill; ? casts, 1 mi. N. of Midway.

Type.—Aldrich collection (specimen figured).

Solarium sp., Pl. 12, fig. 6.

This is evidently a young shell and bears a strong resemblance to the smaller whorls of *S. cupola* Heilprin, but the largest whorl does not begin to show signs of a deflected margin, nor are the subsutural spirals present. Better specimens may permit of specific description.

Locality.—ALABAMA: Matthews' Landing.

Specimen figured.—Paleontological Museum, Cornell Univ.

RISSOINA.

Rissoina alabamensis, Pl. 12, fig. 7.

Syn. *Rissoina alabamensis* Ald., Bull. Am. Pal., No. 2, 1895, p. 14, pl. 2, fig. 8.

Aldrich's original description.—"Shell solid; whorls nine, the first four smooth, embryonic, then follow four rounded adult whorls showing fine spiral lines which are slightly pitted at the intersections of lines of growth with them; body whorl rounded, convex, contracted below centre to form the base on which the lines of growth are more strongly marked; aperture oblong-ovate outer lip channelled anteriorly, thickened and expanded posteriorly and strongly sigmoid.

"*Locality.*—Matthews' Landing, Ala."

Type.—Aldrich's collection.

Specimen figured.—Lea Memorial collection, Ac. Nat. Sci., Phila.

KEILOSTOMA.

Keilostoma mediavia n. sp., Pl. 12, figs. 8, 9, a.

Specific characterization.—General form and size as indicated by the figures, though sometimes slightly thicker or less elongate; whorls about eleven, generally with very faint longitudinal plications, uppermost whorls with rounding sides, medial ones with straight sides and body whorl with sometimes a slight medial depression; no spiral striæ; surface semi-polished; suture distinct, somewhat shouldered below; mouth typical of the genus, *i. e.*, with a strong labial callosity which passing beneath comes up on the outside of the labrum as a flattened varix which shows a few longitudinal lines of growth.

Fig. 8 is of a specimen collected by the writer, 1895, and now in Cornell Univ. Pal. collection, while figs. 9, 9a, are of a specimen in the U. S. Nat. Mus. collection, collected by L. C. Johnson about 10 years ago. A few years ago while looking over the Eocene material in the U. S. Nat. Mus. collection, I was struck with the resemblance this form bore to Gabb's *Loxotrema;* but Deshayes' *Keilostoma* seems to fit it so much better I have no hesitation in referring it to that genus. In fact our species is very closely allied to Deshayes' *plicatula*, Coq. Foss. des Env. de Paris, 1824, vol. ii, p. 115, pl. 14, figs. 5, 6, from the lower beds of the Paris Basin Eocene. "Abbecourt près Beauvais."

See also Descr. An. Sans Vert., etc., vol. ii, p. 426.

Localities.—ALABAMA: The exact localities of the U. S. Nat. Mus. specimens are not known though they came from Wilcox Co., Sta. 264. Specimens preserved in the same material, limestone, are in our collection from ½ mi. E. of S. McConnico's, or perhaps 1½ mi. S. W. of Palmer's mill. They are from bed 18 of our section. Others preserved as casts were found in bed 21 of the same general section, that is, in the light, micaceous sandstone ledges beneath Palmer's mill. Still another is from the railroad cut, 1⅓ mile N. E. of Clayton.

Types.—Paleontological Museum, Cornell University, and U. S. National Museum.

CALYPTRÆA.

Calyptræa sp., Pl. 12, figs. 10, 11.

The two specimens (casts only) were collected in the R. R.

cut, 1⅓ miles N. E. of Clayton. Another specimen was obtained 1 mile N. of Midway.

XENOPHORA.

Xenophora sp., Pl. 12, figs. 12, 13.

Two casts of specimens belonging to this genus were found in Alabama, both of which are herewith figured. One is from 1 mile N. of Midway, the other from 1 mile N. of Prairie Bluff.

NATICA.

Natica (*Girodes*) *alabamiensis*, Pl. 12, fig. 14.

Syn. *N.* (*G.*) *alabamiensis* Whitf., Am. Jr. Conch., 1, 1865, p. 265, pl. 27, figs. 9, 10.

Whitfield's original description.—"Shell oblique, subpalutose; spire elevated; volutions four, flattened on top; aperture large, broadly subovate, columella flattened and slightly grooved; umbilicus minute or none; surface marked by fine, wavy revolving lines, strongest near the upper part of the volution, crossed by distinct lines of growth.

"*Dimensions.*—Length .80 inch, width .62 inch.

"*Locality.*—Six miles above Claiborne, Alabama, west side of river."

Localities.—ARKANSAS: ? Near Olsen's switch, a few miles S. W. of Little Rock.
ALABAMA: Naheola; Matthews' Landing; 1 mi. W. of Oak Hill P. O.

Type.—Hall collection.

Natica mediavia n. sp., Pl. 12, fig. 15.

Specific characterization.—General form and size as indicated by the figure (a cast); composed of about 5 whorls, very small above, while the body whorl is very large; sides of whorls rounded, slightly shouldered or flattened above; suture well marked; mouth elliptical in general outline but pointed above; outer lip acute at the margin but thickening very rapidly within and forming a varix; substance of the shell thin.

The thickened outer lip reminds one of *N. subpatula* Desh., of the Paris Basin, but the lip thickens even more rapidly. Fragments indicate specimens of considerably larger size than the specimen figured.

Localities.—GEORGIA: Uppermost Midway limestone as exposed on Chattahoochee river at Ft. Gaines.

ALABAMA: 1⅓ mi. N. E. of Clayton.

Type.—Paleontological Museum, Cornell University. Specimen figured, from Ft. Gaines.

Natica limula, Pl. 12, fig. 16.

Syn. *N. limula* Con., Foss. Sh. Tert. Form. Am., Nov., 1833, p. 46.
N. gibbosa Lea, Cont. to Geol., Dec., 1833, p. 108, pl. 4, fig. 92.
N. (*Neverita*) *mamma* De Greg., *partim*, Mon. Faun. Eoc. Ala., 1890, p. 152.

Conrad's original description.—"Obliquely suboval, smooth, with a short convex spire; umbilicus nearly closed by a profound callus; aperture elliptical."

The specimen so described was from the Claiborne sand and is now in the collection of the Ac. Nat. Sci., Phila.

The specimen herewith figured is from Matthews' Landing and belongs to the Chamberlain–Lea collection at the Ac. Nat. Sci., Phila. We are not aware that the species has been recorded before from so low a horizon.

Natica (*Polinices*) *onusta*, Pl. 12, fig. 17.

Syn. *N.* (*P.*) *onusta* Whitf., Am. Jr. Conch., 1, 1865, p. 264.

Whitfield's original description.—"Shell obliquely elliptical; spire low, a very small portion only of the inner volutions showing; volutions flattened in the upper part, and abruptly rounded below; suture slightly channelled; aperture very large, obliquely semilunate; callus very large, entirely filling the umbilical portion of the shell; surface smooth, or marked only by fine lines of growth.

"*Locality.*—Six miles below Prairie Bluff, Alabama."

Type.—Hall collection.

Natica saffordia n. sp., Pl. 12, fig. 18.

Syn. *N. rectilabrum* Gabb and Safford *non* Con., Geol. Tenn., Safford, 1869, p. 419.

Specific characterization.—Size and form about as figured though there is a slight tendency towards a humeral zone just below the suture, somewhat as in *alabamiensis* though far less marked; whorls from four to five; umbilicus small, nearly closed by the thickening of the labium. In young specimens, as in many species of the genus, there is a trace of a notch or transverse groove across the labium at about the horizon of the upper margin of the umbilicus.

Mr. Stanton of the U. S. National Museum has sent us a fine set of *N. rectilabrum* Con. from the upper Cretaceous. They are far more elongate and *Vivipara*-shaped than *saffordia*.

Locality.—TENNESSEE: 2 mi. E. of Middleton.

Type.—Dr. Safford's collection.

Natica reversa, Pl. 12, fig. 19.

Syn. *N. reversa* Whitf., Am. Jr. Conch., 1, 1865, p. 264.

Whitfield's original description.—"Shell small, globose; spire moderately elevated; volutions ventricose; suture deep; aperture semicircular, and moderately large, equaling two-thirds the length of the shell; outer lip sharp; inner lip slightly thickened, spreading over the preceding volution; callus represented by a thickened spiral ridge, deposited on the left side of the umbilicus, and uniting with the peristome at the inner basal angle; substance of the shell thick; surface polished.

"*Dimensions.*—Height .3 inch.

"*Locality.*—Nine miles below Prairie Bluff, Ala."

Localities.—ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill.

Type.—Hall collection.

Natica eminula, Pl. 12, fig. 20.

Syn. *N. eminula* Con., Foss. Sh. Tert. Form., 1833, p. 46.
N. parva and *minor* of Lea's Contributions, etc.

Conrad's original description.—"Obovate, with smooth convex volutions and a prominent conical spire; umbilicus elliptical, not contracted by the callus; aperture obovate, rather more than half the length of the shell."

This was described from the Claiborne sand.

Localities (Midway).—ALABAMA: Naheola; Matthews' Landing; 1 mi. W. of Oak Hill P. O.

Type.—Ac. Nat. Sci., Phila.

Natica perspecta, Pl. 12, fig. 21.

Syn. *N. perspecta* Whitf., Am. Jr. Conch., 1, 1865, p. 264.

Whitfield's original description.—"Shell oblique, of medium size; substance thick; volutions four in the largest individuals, very ventricose; spire low; suture very distinctly channelled;

umbilicus proportionally large, entirely destitute of a callus, the volutions being distinctly visible to the apical one; aperture semilunate, the inner lip spreading somewhat on the preceding volution, opposite the umbilicus it is thin and emarginate; outer lip sharp; surface polished.

"This beautiful little shell differs from any described species, in the deep channelling of the suture and the characters of the umbilicus.

"*Locality.*—Nine miles below Prairie Bluff, Ala."

Localities.—ALABAMA: ½ mi. W. of Graveyard hill; Matthews' Landing.

Type.—Hall collection.

AMAURA.

Amaura (*Amauropsis?*) *tombigbeensis* n. sp., Pl. 12, fig. 22.

Specific characterization.—Size and general form as indicated by the figure; non-umbilicate; shell very thin and fragile, marked by very fine, even lines of growth and by a vast number of fine, even, revolving, incised lines, tending slightly to alternate in depth about the umbilical region; suture distinct, whorls slightly shouldered below the suture, two or three stronger revolving lines on this humeral zone; lines of growth when passing downward from the suture, are directed slightly backwards as compared with the axis of the shell.

Localities.—ALABAMA: 4 mi. below Black Bluff, Tombigbee river; 1 mi. N. of Midway.

Type.—Paleontological Museum, Cornell Univ.

SCALA.

Scala sp, Pl. 12, fig. 23.

A specimen of this genus was found by the writer in a collection from near Olsen's switch, a few miles southwest of Little Rock, Ark., and was figured in vol. ii, Geol. Surv. Ark., 1892, pl. 3, fig. 2, and is figured herewith. Last summer other, larger, but more imperfect specimens were found ¾ mi. W. of Prairie Bluff, in bed *e*, at the very base of the Midway. They seem to belong to the same species as the Arkansas specimen but are about ½ inch in diameter at base.

SOLARIELLA.

Solariella alabamensis, Pl. 12, fig. 24.

Syn. *Trochus alabamensis* Ald., Bull. No. 1, Geol. Surv. Ala., 1886, p. 35, pl. 5, fig. 16.

Aldrich's original description.—"Shell trochiform, whorls seven, suture deeply impressed, surface marked with four to six strong, revolving lines, with finer ones between, crossed by numerous fine longitudinal striations, which are strongest at the intersecting points; base of the body whorl with finer lines. Umbilicus deep, defined by a sharp carina; aperture rounded; outer lip crenate on its edge, the crenulations running some distance within; inner lip smooth.

"*Locality.*—Matthews' Landing, Ala.

"Generally is smaller than the type; not rare."

Localities.—ALABAMA: Matthews' Landing; 1 mi. W. of Oak Hill.

PLEUROTOMARIA.

"*Pleurotomaria?*" sp., Pl. 12, figs. 25, a.

Syn. *Pleurotomaria?* Ald., Geol. Surv. Ala., 1894, p. 247.

Mr. T. H. Aldrich has kindly sent me these two figures of a specimen which was labelled "Allenton, Wilcox Co., Ala." It belongs to the State Museum at Tuscaloosa. Without seeing the specimen it is unwise to attempt a description of it. From the appearance of the figures, however, it is almost certain that it is from the horizon of beds 18 or 19 of the section on p. 31.

FISSURELLA.

Fissurella mediavia n. sp., Pl. 12, figs. 26, a.

Specific characterization.—General form and size as indicated by the fragment figured; surface marked by about 60? subequal ribs which are crossed by transverse lines making small, raised folds on the top of the ribs.

It has seemed worth while to name, describe and figure this fragment since it is the only member of this genus known from the lower Eocene.

Locality.—ALABAMA: Top of bed 19, 1½ mi. S. W. of Palmer's mill.

Type.—Paleontological Museum, Cornell Univ.

Cephalopoda.

ENCLIMATOCERAS.

Enclimatoceras ulrichi, Pls. 13, 14, 15.

Syn. *Nautilus texanus* White, Proc. U. S. Nat. Mus., vol. iv, 1881, p. 137.
Enclimatoceras (*Nautilus*) *ulrichi* White, Bull. U.S. Geol. Surv., No. 4, 1884, p. 17, pls. 7, 8, 9.
Enclimatoceras hyatti Ald., Bull. Geol. Surv. Ala., No. 1. 1886, p. 60.
Enclimatoceras ulrichi Harris, Ann'l Rep't Geol. Surv. Ark., 1892, p. 36.

This fossil being obviously one of the most characteristic of the Midway stage from Texas to Alabama inclusive, it is deemed advisable to here insert Dr. White's account of it together with his original description as found in Bulletin No. 4 of the U. S. Geological Survey, pages 16 and 17.

"ON THE NAUTILOID GENUS ENCLIMATOCERAS HYATT, AND A DESCRIPTION OF THE TYPE SPECIES.

"In the year 1880 Mr. E. O. Ulrich sent to the Smithsonian Institution a small collection of fossils which he had obtained from the Cretaceous strata near Little Rock, Ark. A part of these fossils were described by me in Vols. III and IV of Proceedings of the United States National Museum; but the Nautiloid shell now described was then only casually noticed. Its peculiarities were recognized at that time, and the specimens were laid aside with the hope that better material might be procured for study. Other specimens belonging to this or a closely related species were afterward collected by Mr. Lawrence C. Johnson from strata supposed to be of Cretaceous age, in Wilcox county, Alabama, but they are no more perfectly preserved than the Arkansas specimens.

"Prof. Alpheus Hyatt having had in hand an exhaustive work on *Nautilus* and its allies, the Arkansas specimens were placed with him for examination. In a preliminary work of his, just published, he divides the genus *Nautilus* as it has been generally recognized, into numerous genera besides those previously proposed by other authors. To one of these groups he has given the generic name *Enclimatoceras*, and made the species here described the type of the genus. The following is his generic diagnosis, which he has also published in the Proceedings of the Boston Society of Natural History, Vol. XXII, 1884, p. 270.

"Genus ENCLIMATOCERAS Hyatt.

"Enclimatoceras includes species of the Trias to the Tertiary, inclusive, which are connected by the outlines of their sutures. The whorls are involute from an early stage, and compressed. The abdomens are rounded, but become acute in many species. The sutures have prominent ventral saddles, flatted in species with rounded abdomens, and acute in those with acute abdomens; never divided by ventral lobes. The lateral lobes are deep, and the lateral saddles well marked. The ventral saddles in the young are broad and closely resemble the ventrals of the *Hercoglossæ*, as do also the broad lateral saddles of the later larval stages in some species. There are no annular lobes at any stage in the Triassic, according to Mojsisovics. They do not seem to be present in some of the Jurassic and Cretaceous species, at least during the early stages, and are very small in some adults. The Triassic species are nearly related to *Grupoceras*, according to Mojsisovics' figures and descriptions in 'Das Gebirge um Hallstatt.' The siphon in this type is a little below the center in the young, though ventral in the adult; and this also agrees with the characteristics of *Enclimatoceras styriacus*, sp. Mojsisovics, of the Trias, and *Grupoceras*. Nevertheless there is no ventral lobe at any stage; the annular lobe is absent in the Triassic forms, and young of later forms; and the siphon in two species is short-funneled, with connective walls, or ellipochoanoidal. Type, *Enclim.* (*Naut.*) *ulrichi* White."

"*Enclimatoceras* (*Nautilus*) *ulrichi* White.

* * * * * *

"Shell moderately large; somewhat narrowly but regularly rounded upon the periphery in the adult state, and broadly rounded at the sides; whorls almost completely involute, the umbilici being very small; septa somewhat deeply concave; ventral saddles large, prominent, and regularly rounded; lateral lobes broad and moderately deep; lateral saddles prominent and narrow, and rounded at the outer end, and also becoming laterally prominent in the later formed septa of adult shells. The character of the surface is unknown, but it is apparently plain; and the test was moderately thin. In the young state the shell was more globose in form, and the septa were much less deeply lobed.

"All the specimens which have yet come under my observation are in the condition of natural casts, and all are imperfect. The best one of these specimens is figured on plates VII, VIII and IX, [represented herewith by Pls. 13, 14, 15] together with a fragment showing the inner volutions. The outlines which are added to the figures represent the supposed outline of the aperture of the adult shell.

"The diameter of the coil of the type specimen, when perfect, was apparently about 180 millimeters. The greatest transverse diameter about 125 millimeters. Some of the specimens already referred to, which were collected in Alabama by Mr. Johnson, indicate a considerably larger size.

"In Vol. I of the Transactions of the St. Louis Academy of Science Dr. Shumard described a form under the name of *Nautilus texanus*, but which he did not figure. Judging from his description, it seems to agree with the form here described, except for the material difference that it is marked by numerous flexuous transverse ribs, while the surface of our form is evidently plain. The difference between *E. ulrichi* and most of the other Cretaceous Nautiloid shells of the United States has now been made generic by Professor Hyatt, and specific comparisons are therefore unnecessary. The collection sent by Mr. Ulrich to the Smithsonian containing the type specimens of this species, also contains representatives of numerous other species, but all of them, like these types, are imperfect. Among them are *Callianassa ulrichi* White, *Tubulostium dickhauti* White, *Gryphæa pitcheri* Morton?, *Turritella*, *Anchura*, *Axinæa*, *Cucullæa*, etc.

"The type specimens bear the Museum catalogue number 8349; and permission to use them in the preparation of this article has been given by the Director of the Museum."

The surface of this shell is indeed nearly smooth but the substance of the same is quite thick, say at least one-fourth of an inch in many instances. It will be noticed, moreover that Dr. White regards this as a Cretaceous species. This error was first pointed out by L. C. Johnson in his studies of the Pine Barren region of Alabama in 1883. He showed that the Enclimatoceras rock overlies a crystalline limestone holding *Turritella*, *Cardita*, a *Rosellaria* and other forms. (See Bull. 43, U. S. Geol. Surv., 1887, 65-66).

Our figures of this species are from electrotype plates made from the originals used in printing Pls. 7, 8, 9 of Bulletin No. 4 of the U. S. Geological Survey.

This species ranges from the highest to the lowest Midway Eocene bed. (See p. 13).

Localities.—TEXAS: Brazos river, about one mile above the Milam–Falls county line; from ½ to 1 mile up Salt branch from Little Brazos river.

ARKANSAS: Near Olsen's switch, a few miles S. W. of Little Rock (type locality).

TENNESSEE: Hannah's, 1¾ mi. N. of Crainesville.
MISSISSIPPI: ½ mi. N. of Ripley; Blue Mt., near Ripley (pp. 24-25).
ALABAMA: Black Bluff; 4 mi. below Black Bluff, Tombigbee river; almost any of the fields in the vicinity of Prairie Bluff; field 1 mi. N. of Midway; Palmer's mill, from rocks shown in our frontispiece; ½ mi. W. of Graveyard hill; 1 mi. W. of Oak Hill P. O., bed 9; 1 mi. N. of Allenton; Josh Hunter's, Hamburg; 2 mi. N. of Snow Hill; 3½ mi. N. E. of Snow Hill (See Pl. II, opp. p. 32).

Type.—U. S. National Museum collection.

* * *

PLATE I.

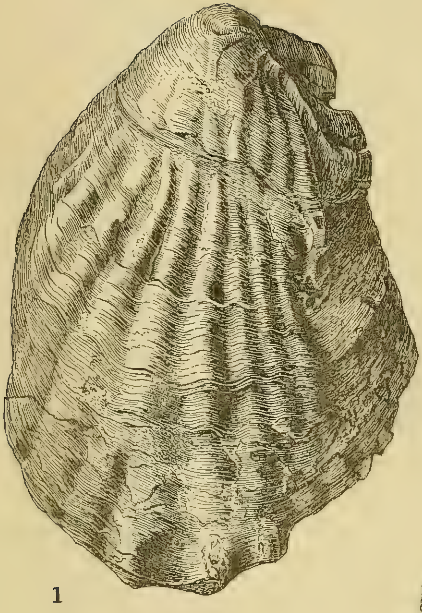
EXPLANATION OF PLATE I.

(II)

Page.

Fig. 1. *Ostrea crenulimarginata* Gabb.............................. 45, **159.**
Exterior, left valve.*
a. Interior, left valve.*
2. *Ostrea pulaskensis* Harris................................... 46, **160.**
Exterior, left valve.
a. Posterior view, left valve.
b. Exterior, right valve.
c. Interior, right valve.
3. *Ostrea pulaskensis* Harris. Small variety found immediately above the Cretaceous–Eocene contact line in the vicinity of Prairie Bluff, Ala.
Posterior view, left valve.
a. Exterior, left valve.

NOTE.—All figures are natural size unless otherwise indicated. Those marked (*) in the explanation were drawn by Dr. McConnell of Washington for Mr. Aldrich, and were lent by the latter for use in this publication. Those marked (†) were drawn by McConnell and were published elsewhere as shown by the synonymy. All others were drawn by the author of this Bulletin.



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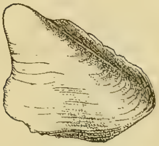

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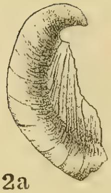

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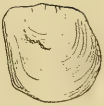

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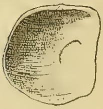

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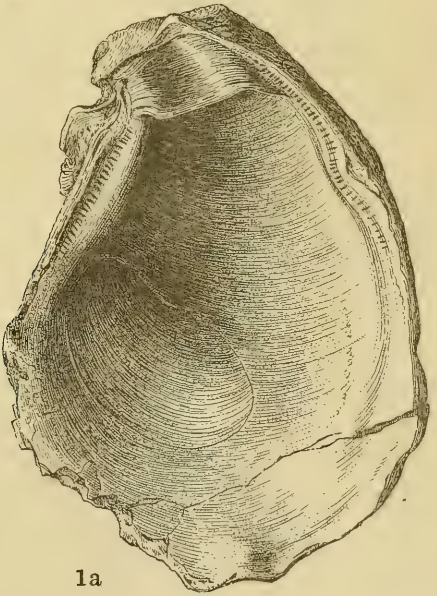

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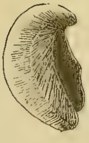

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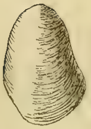

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PLATE 2.

EXPLANATION OF PLATE 2.

(**12**)

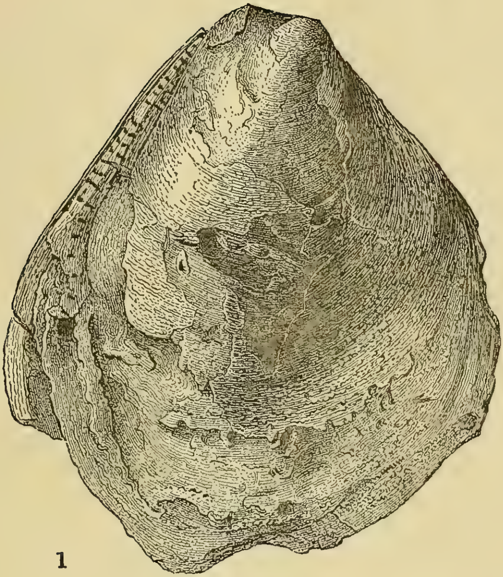
Page.

Fig. 1. *Ostrea crenulimarginata* Gabb.......................... 45, **159.**
Exterior, right valve.*
a. Interior, right valve.*

2. *Plicatula?*.. 47, **161.**
Exterior.
a. Interior.

3. *Pecten alabamensis* Aldrich.............................. 48, **162.**
Interior view, x 3.

4. *Avicula* sp... 48, **162.**
Cast of left valve.
a. Cast of right valve.



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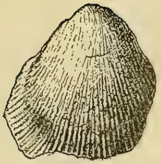

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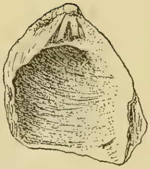

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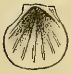

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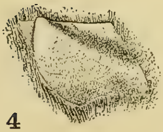

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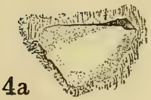

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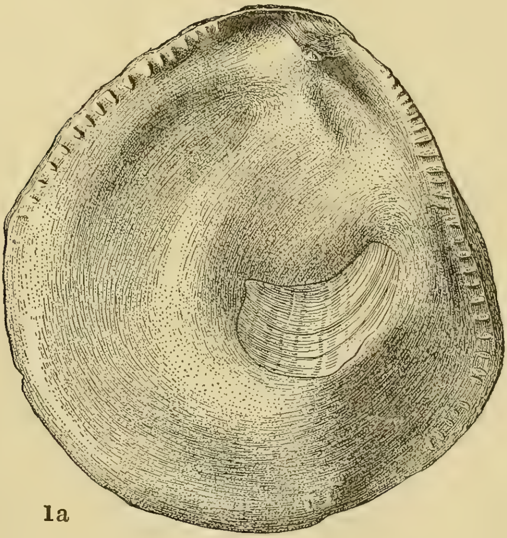

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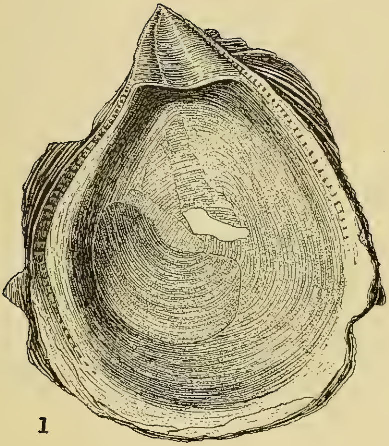
PLATE 3.

EXPLANATION OF PLATE 3.

(13)

Page.

Fig. 1. *Ostrea crenulimarginata* Gabb........................ 45, **159.**
(Type specimen).
2. *Perna cornelliana* n. sp................................ 48, **162.**
3. *Perna cornelliana* n. sp................................ 48, **162.**
4. *Modiola saffordi* Gabb................................ 49, **163.**
5. *Modiola saffordi* Gabb; from Texas; young...... 49, **163.**
6. *Modiola subpontis* n. sp................................ 49, **163.**
Cast of left valve, x 2.
a. Fragment of exterior imprint, showing markings.
7. *Lithodomus gainesensis* n. sp........................ 50, **164.**
Cast of left valve, x 2.
a. Cast of right valve, x 2.
8. *Arca* sp.. 50, **164.**
From a gutta-percha mould, x 2.
9. *Arca*, same species as fig. 8.
From a gutta-percha mould.
a. Cast of interior of fig. 9.
10. *Cucullæa macrodonta* Whitfield.................... 51, **165.**
Exterior of left valve.
a. Exterior of right valve.
11. *Cucullæa saffordi* Gabb................................ 51, **165.**
(Copy of Gabb's figure).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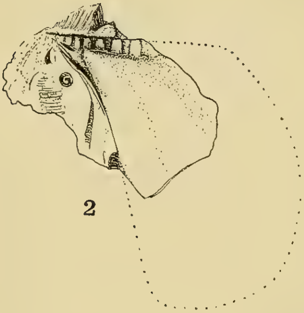
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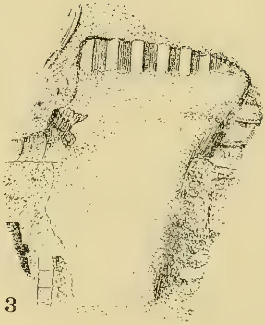
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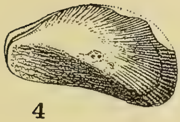
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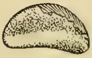
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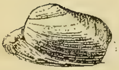
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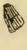
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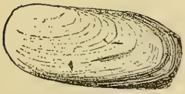
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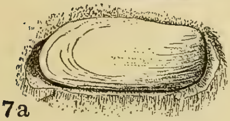
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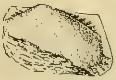
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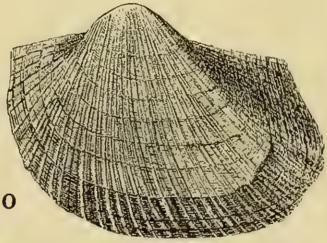
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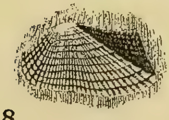
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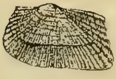
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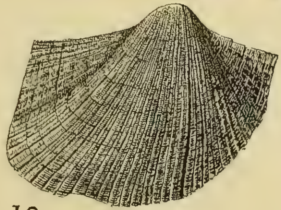
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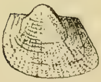
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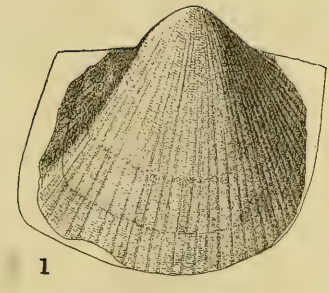
PLATE 4.

EXPLANATION OF PLATE 4.

(**14**)

		Page.
Fig. 1.	*Cucullæa saffordi* var.	51, **165.**
2.	*Cucullæa saffordi* Gabb	“ “
[illegible]	*Pectunculus* sp.	53, **167.**
	Nucula mediavia n. sp.	“ “
5.	*Nucula ovula* Lea	54, **168.**
6.	*Yoldia kindlei* n. sp.	56, **170.**
7.	*Yoldia eborea* Con.	“ “
8.	*Leda milamensis* Harris	54, **168.**
9.	*Leda saffordana* n. sp.	55, **169.**
10.	*Leda elongatoidea* var.? Ald.	“ “
11.	*Leda quercollis* n. sp.	“ “
12.	*Venericardia alticostata* Con. var.	57, **171.**
13.	*Venericardia planicosta* Lam.*	58, **172.**
14.	*V. planicosta* var. *smithi* Ald.*	59, **173.**



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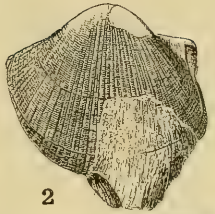

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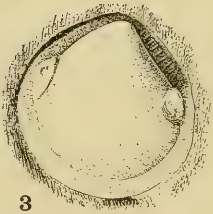

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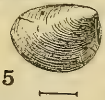

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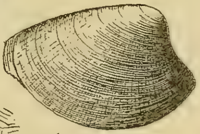

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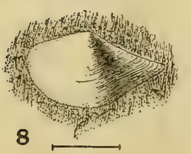

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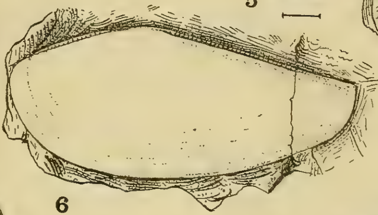

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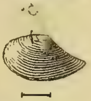

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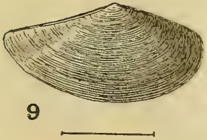

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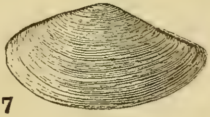

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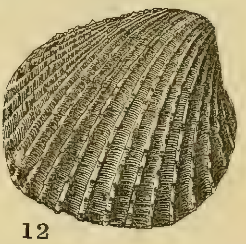

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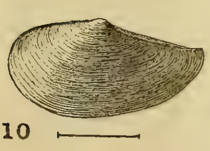

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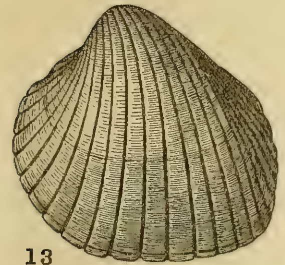

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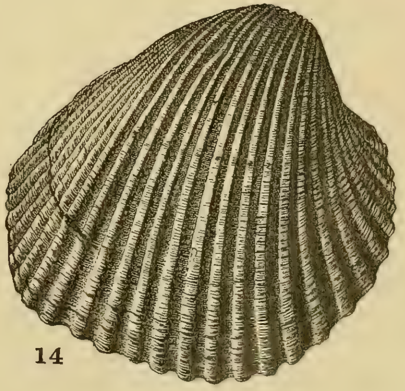

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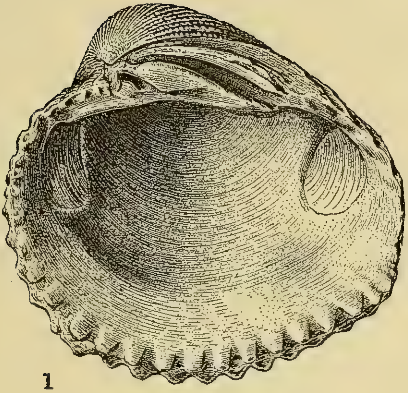
PLATE 5.

EXPLANATION OF PLATE 5.

(**15**)

		Page.
Fig. 1.	*Venericardia planicosta* var. *smithi* Ald.	59, **173.**
	Interior view of fig. 14, pl. 4.*	
2.	*Venericardia planicosta* var. *smithi* Ald.	" "
	Exterior view.*	
	a. Interior view.*	
3.	*Venericardia alticostata* Con. var. (from Texas)	57, **171.**
4.	*Astarte smithvillensis* var. *mediavia* Harris.	61, **175.**
5.	*Astarte subpontis* n. sp.	62, **176.**
	View from above.	
	a. Lateral view, cast.	
	b. Lateral view, gutta-percha mould.	
6.	*Astarte aldrichiana* n. sp.	" "
	Exterior view.	
	a. Interior view.	
7.	*Crassatella gabbi* Safford. (Type)	63, **177.**
	Interior view.	
	a. Exterior view.	
8.	*Crassatella gabbi* Safford.	" "
	Showing hinge structure.	
9.	*Crassatella gabbi?* Safford, short form.	" "
10.	*Crassatella gabbi* Safford, Brazos river, Texas.	" "
11.	*Crassatella gabbi* Safford,† " " "	" "



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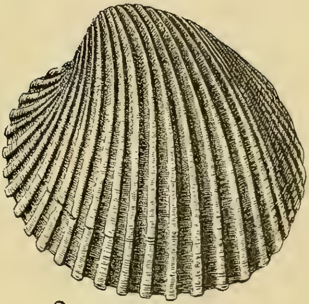

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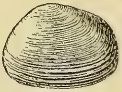

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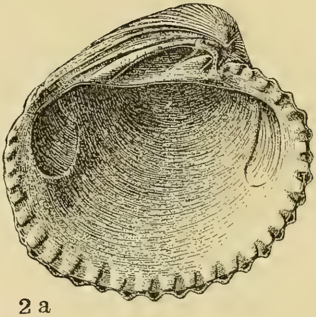

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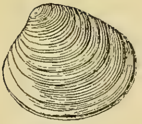

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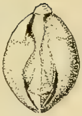

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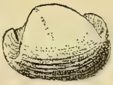

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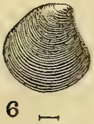

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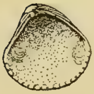

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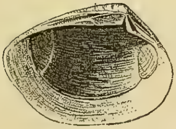

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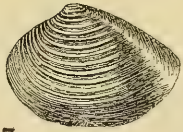

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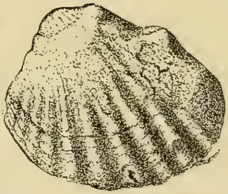

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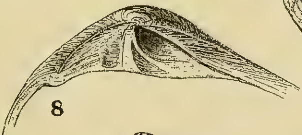

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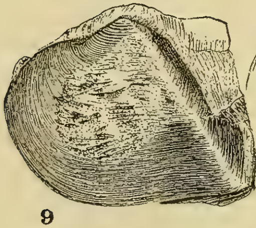

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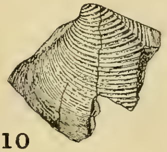

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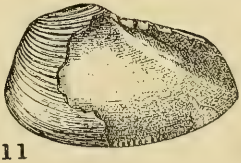

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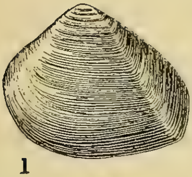
PLATE 6.

EXPLANATION OF PLATE 6.

(**16**)

Page.

Fig. 1. *Crassatella sepulcollis* n. sp.............................. 64, **178.**
Exterior view.
a. Interior view.
2. *Protocardia nicolletti* var................................ 65, **179.**
3. *Cardium* sp., 18 mi. S. E. of Eagle Pass, Texas.
4. *Chama gainesensis* n. sp................................ 66, **180.**
Cast.
a. Gutta-percha mould, showing exterior marking.
5. *Isocardia mediavia* n. sp................................ “ “
6. *Meretrix ripleyana* Gabb................................ 67, **181.**
7. *Meretrix ripleyana?* Gabb................................ “ “
8. *Tellina* sp.. 68, **182.**
9. *Corbula subcompressa* Gabb.............................. “ “
10. *Lucina claytonia* n. sp.................................. 69, **183.**
Exterior view, gutta-percha mould.
a. Interior view, gutta-percha mould.
11. *Lucina fortidentalis* n. sp.............................. “ “
Exterior, cast.
a. Interior, cast.
12. *Gastrochæna gainesensis* n. sp., x 2................... 70, **184.**
Cast of left valve.
a. Impression of exterior in its original matrix.
13. *Gastrochæna cimitariopsis* n. sp., x 2................. “ “
14. *Gastrochæna* sp., young, (from Ft. Gaines), x 2.
15. *Martesia dalliana* n. sp., x 1⅔........................ 71, **185.**
16. *Verticordia* sp.. “ “
17. *Pholadomya mauryi* n. sp................................ “ “
Exterior, right valve.
a. Anterior view.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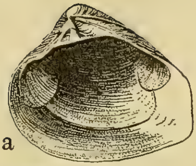
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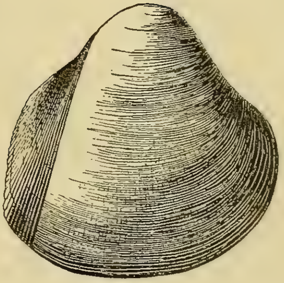
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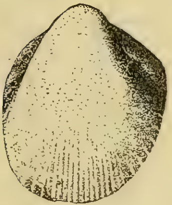
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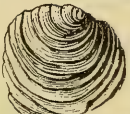
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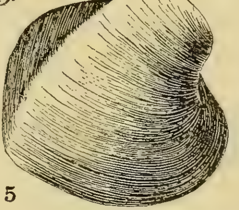
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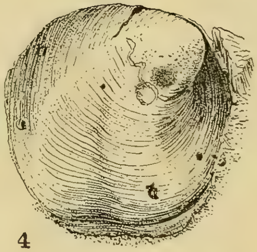
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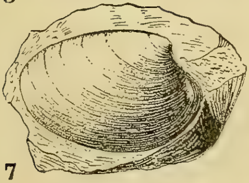
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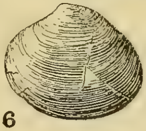
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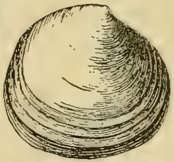
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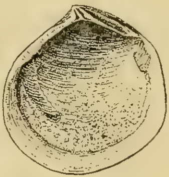
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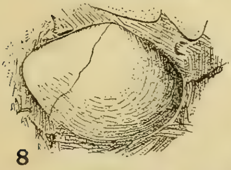
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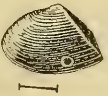
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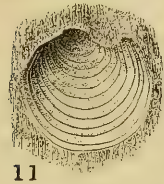
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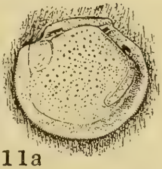
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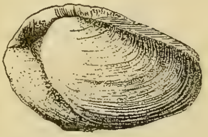
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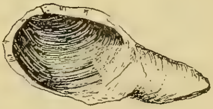
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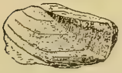
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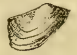
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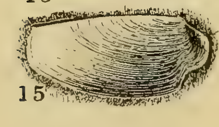
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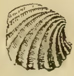
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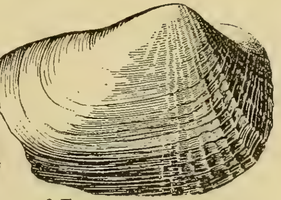
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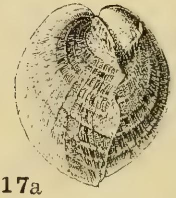
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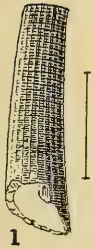
PLATE 7.

EXPLANATION OF PLATE 7.

(**17**)

		Page.
Fig. 1.	*Dentalium mediaviense* n. sp. An enlarged fragment; from ½ mi. W. of Graveyard Hill, Ala. a. The same, internal cast showing general form; from ½ mi. N. of Ripley, Miss.	73, **187.**
2.	*Cadulus turgidus* Mr., x 3	" "
3.	*Tornatellæa bella* Con.	74, **188.**
4.	*Tornatellæa quercollis* n. sp.	" "
5.	*Atys robustoides?* Ald.	" "
6.	*Cylichna meyeri* Ald.	75, **189.**
7.	*Cylichna galba?* Gabb. x 3	" "
8.	*Pleurotomella whitfieldi* Ald.	76, **190.**
9.	*Surcula adeona* Whitf., x 2	" "
10.	*Surcula adeona* Whitf.	" "
11.	*Surcula persa* Whitf.	77, **191.**
12.	*Surcula anacona* Har.†; slightly enlarged	" "
13.	*Surcula ostrarupis* Harris †	78, **192.**
14.	*Pleurotoma* sp., x 1½	" "
15.	*Surcula longipersa* n. sp., x 1½	" "
16.	*Pleurotoma mediavia* n. sp., x 2	79, **193.**
17.	*Pl.* (*Cythara?*) *leania* n. sp.	" "
18.	*Pl.* (*Drillia*) *quercollis* n. sp.	" "
19.	*Olivella mediavia* n. sp.	80, **194.**
20.	*Caricella leana* Dall	" "
21.	*Scaphella showalteri* Ald.	81, **195.**
22.	*Voluta lyroidea* Ald.*	82, **196.**
23.	*Scaphella* sp. (from ½ mi. N. of Ripley, Miss.)	" "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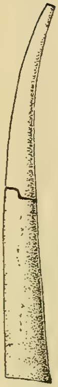
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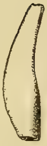
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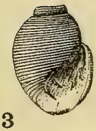
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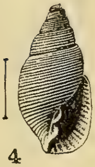
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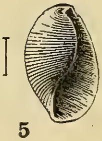
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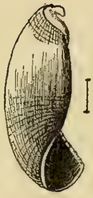
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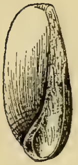
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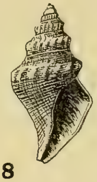
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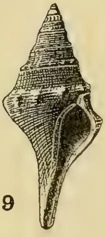
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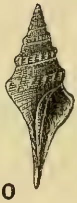
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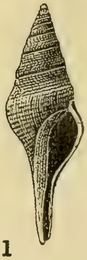
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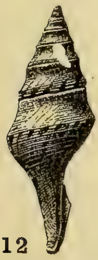
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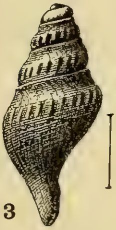
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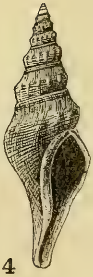
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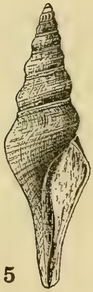
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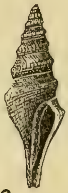
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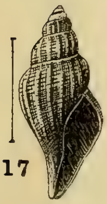
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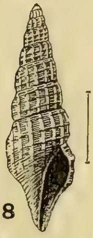
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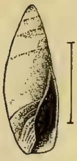
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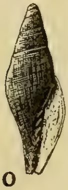
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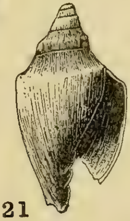
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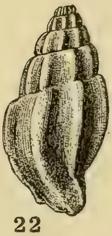
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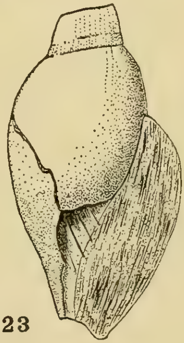
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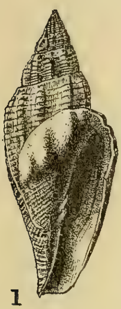
PLATE 8.

EXPLANATION OF PLATE 8.

(18)

		Page.	
Fig. 1.	*Volutilithes rugatus* Con.	83,	**197.**
2.	*V. rugatus* var. *saffordi* Gabb.	"	"
3.	*Volutilithes limopsis* Con.	84,	**198.**
4.	*Volutilithes quercollis* n. sp.	85,	**199.**
5.	*Lyria wilcoxiana* Ald.	"	"
6.	*Voluta florencis* n. sp.	82,	**196.**
	Gutta-percha mould.		
	a. Internal cast.		
7.	*Mitra subpontis* n. sp.	86,	**200.**
	Gutta-percha mould.		
	a. Internal cast.		
8.	*Mitra hatchetigbeensis?* Ald.	"	"
9.	*Fusus quercollis* n. sp.	"	"
10.	*Fusus hubbardanus* n. sp.	87,	**201.**
11.	*Fusus hubbardanus* n. sp.	"	"
12.	*Fusus meyeri* Ald. var.	"	"
13.	*Fusus ostrarupis* Har.	88,	**202.**
14.	*Fusus* (*Latirus*) *tortilis* Whitf.	89,	**203.**
15.	*Fusus mohri* Ald.	"	"
16.	*Strepsidura? mediavia* n. sp.	91,	**205.**
	Back view.		
	a. Front view.		
17.	*Strepsidura? mediavia* n. sp.	"	"
	Showing columellar plaits.		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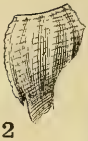
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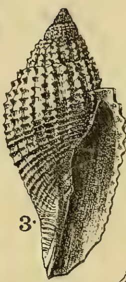
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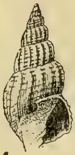
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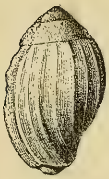
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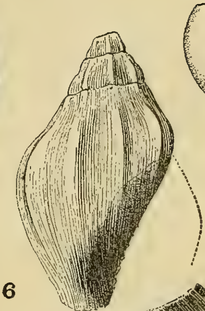
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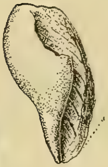
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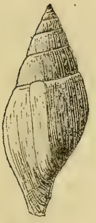
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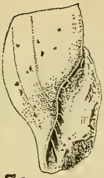
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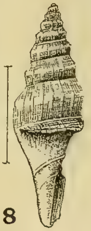
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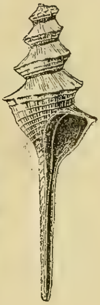
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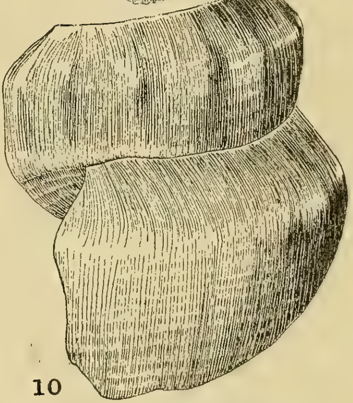
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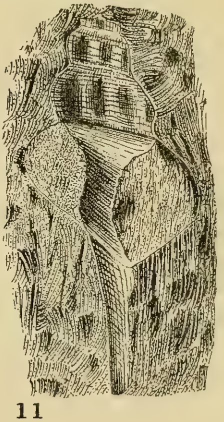
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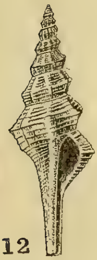
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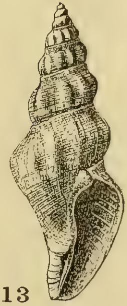
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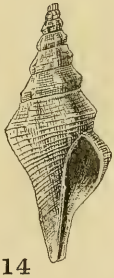
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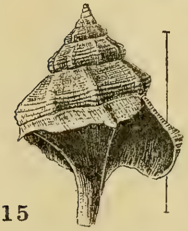
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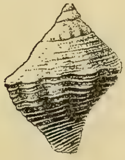
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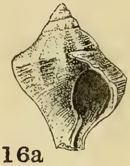
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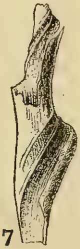
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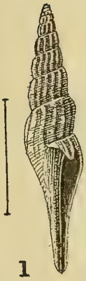
PLATE 9.

EXPLANATION OF PLATE 9.

(**19**)

		Page.
Fig. 1.	*Exilia pergracilis* Con.	90, **204.**
2.	*Pyropsis perula* Ald.	" "
3.	*Strepsidura heilprini* Ald.	91, **205.**
4.	*Leucozonia biplicata* Ald.	92, **206.**
5.	*Mazzalina impressa* Gabb, (crushed specimen)	" "
6.	The same species. Type figured by Gabb.	" "
7.	*Mazzalina impressa* var. *orientalis* n. var.	93, **207.**
8.	*Levifusus pagoda* Heilprin, var.	" "
9.	*Levifusus suteri* Ald.	94, **208.**
10.	*Levifusus trabeatus* Con., var.	95, **209.**
11.	*Levifusus hubbardi* n. sp.; ½ nat. size.	" "
12.	*Levifusus? dalei* n. sp.	96, **210.**
13.	*Fulgur? dallianum* n. sp.	" "
14.	*Neptunea constricta* Ald.	97, **211.**
15.	*Levibuccinum lineatum* Heilprin.	" "
16.	*Pseudoliva unicarinata* Ald.	98, **212.**
17.	*Pseudoliva vetusta* Con., (distorted).	99, **213.**
18.	*Pseudoliva ostrarupis* Har.†; about ¾ nat. size	" "
19.	The same, another view†; about ¾ nat. size.	" "
20.	*P. ostrarupis* var. *pauper* Har.†.	" "
21.	*Pseudoliva scalina* Heilprin.	100, **214.**
22.	*Pseudoliva* sp.	" "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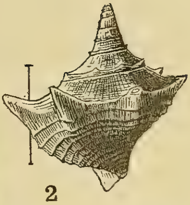
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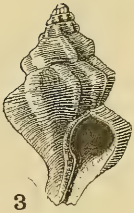
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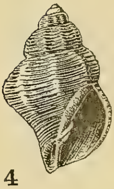
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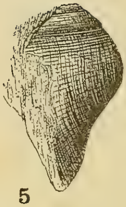
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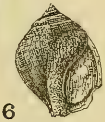
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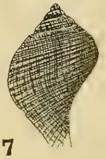
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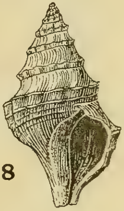
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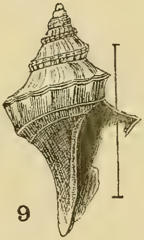
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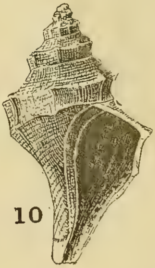
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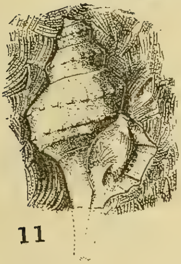
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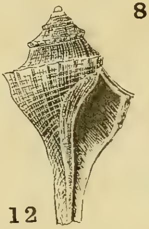
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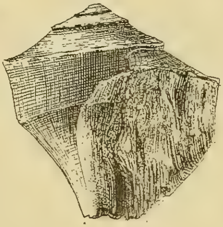
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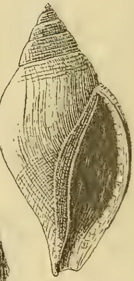
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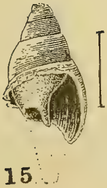
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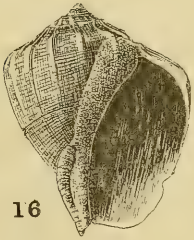
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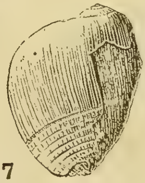
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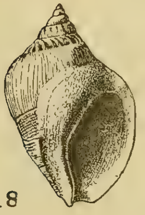
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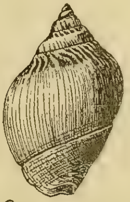
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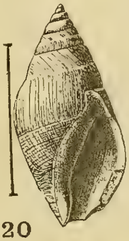
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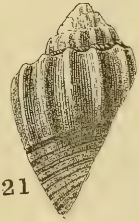
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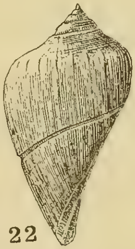
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PLATE 10.

Explanation of Plate 10.

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Page.

Fig. 1. *Trophon morulus* Con., x 2.......................... 100, **214.**

2. *Murex* (*Pteronotus*) *matthewsensis* Ald., x 2... 101, **215.**

3. *Triton* (*Ranularia*) *eocensis* Ald., x 1½......... " "

4. *Triton* (*Simpulum*) *showalteri* Con., x 1½..... 102, **216.**

5. *Pyrula juvenis* Whitf.................................. " "

6. *Pyrula juvenis* Whitf., x 1½, showing quadricarinate body whorl and typically crenulated shoulder.

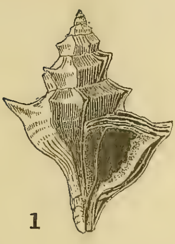
7. *Calyptraphorus velatus* var. *compressus* Ald..... 104, **218.**
   Back view.* (Enlarged.)
   a. Front view.* "
   b. Side view.* "

8. Labrum of the same species; showing acute posterior termination. From a cast, 1⅓ mi. N. E. of Clayton.

9. *Aporrhais* sp.,† x 2.................................. 105, **219.**

10. *Cerithium* (*Companile*) *claytonense* Ald.......... " "
    Showing internal plaits.*

11. The same species; exterior view.*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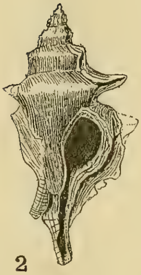
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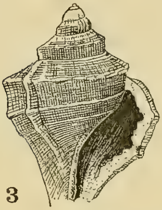
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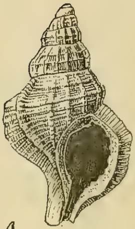
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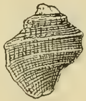
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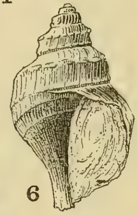
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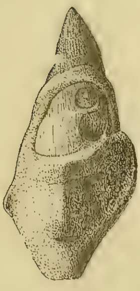
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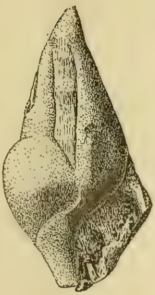
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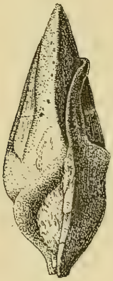
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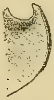
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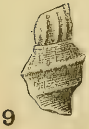
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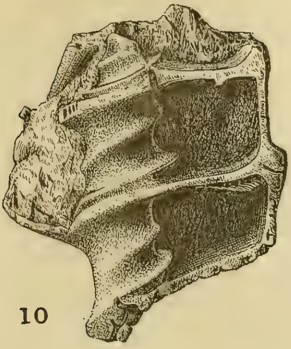
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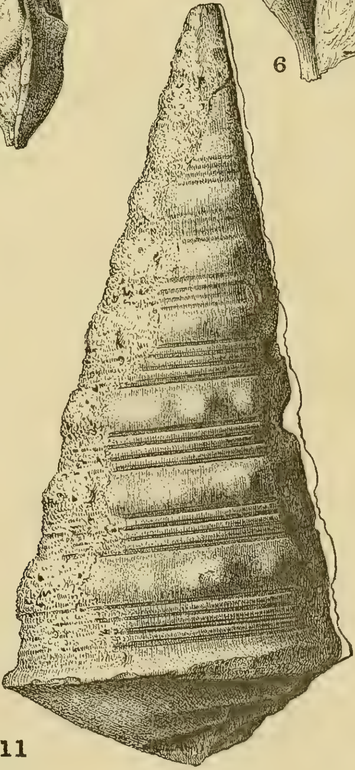
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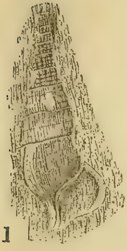
PLATE II.

EXPLANATION OF PLATE 11.

(**21**)

		Page.	
Fig. 1.	*Cerithium gainesense* n. sp.	106,	**220.**
2.	*Cerithium globoleve* n. sp.	“	“
3.	*Cerithium mediaviæ* n. sp.	107,	**221.**
	Gutta-percha mould.		
	a. Aperture of this species.		
4.	*Cerithium penrosei* Harris.†	“	“
5.	*Turritella tennesseensis* Gabb.	108,	**222.**
6.	*Turritella alabamiensis* Whitf.*	109,	**223.**
7.	*Turritella saffordi* Gabb.	“	“
8.	*Turritella mortoni* var.	110,	**224.**
9.	*T. mortoni* var. *levicunea* n. var.	“	“
10.	*Turritella* var. of *humerosa?* *	“	“
11.	*Turritella humerosa* Con.*	“	“
12.	*Turritella humerosa* Con. var.	“	“
13.	*Turritella humerosa* Con. var.†	“	“
14.	*Turritella nerinexa* Har.†	111,	**225.**
15.	*Mesalia pumila* Gabb, (Type specimen)	112,	**226.**
16.	*M. pumila* var. *wilcoxiana* Ald.†; from Texas	“	“
17.	*M. pumila* var. *wilcoxiana* Ald.* (Type)	“	“
18.	*M. pumila* Gabb, var.	“	“
19.	*M. pumila* var. *hardemanensis* Gabb.	“	“
20.	*M. pumila* var. *allentonensis* Ald.*	113,	**227.**
21.	*M. pumila* var. *allentonensis* Ald.*	“	“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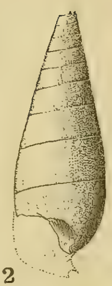
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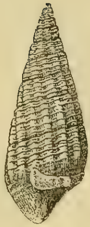
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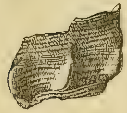
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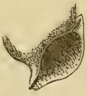
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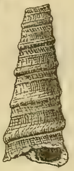
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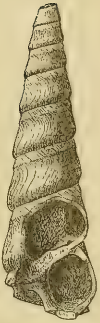
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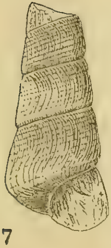
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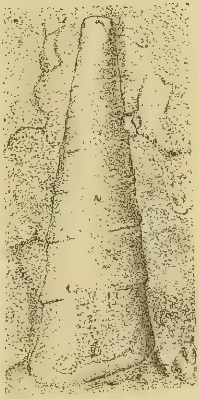
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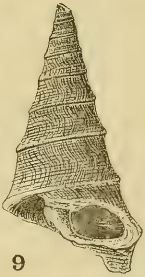
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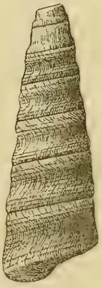
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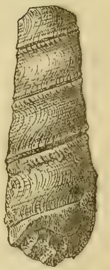
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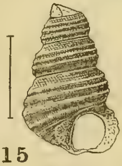
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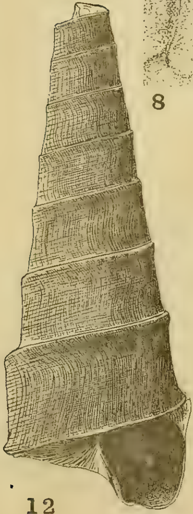
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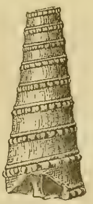
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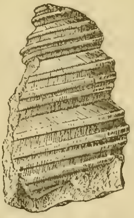
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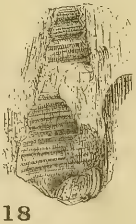
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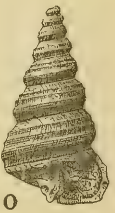
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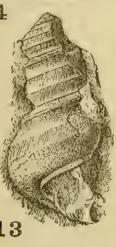
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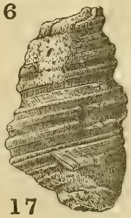
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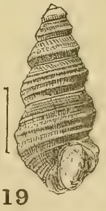
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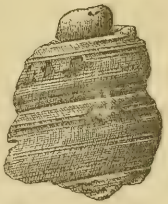
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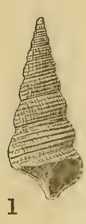
PLATE 12.

EXPLANATION OF PLATE 12.

(**22**)

		Page.
Fig. 1.	*Mesalia alabamiensis* Whitf., x 2	113, **227.**
2.	*Mesalia watsonensis* n. sp.	114, **228.**
3.	*Mesalia?*, x 2	" "
4.	*Solarium alabamense* Dall; 5.3 mm.	" "
5.	*Solarium periscelidium* Dall; 9.0 mm.	115, **229.**
6.	*Solarium* sp.	" "
7.	*Rissoina alabamensis* Ald.	" "
8.	*Keilostoma mediavia* n. sp.	116, **230.**
9.	*Keilostoma mediavia* n. sp.	" "
	Lateral view, showing aperture.	
	a. Front view.	
10.	*Calyptræa* sp.	" "
11.	*Calyptræa* sp.	" "
12.	*Xenophora* sp.	117, **231.**
13.	*Xenophora* sp.	" "
14.	*Natica* (*Girodes*) *alabamiensis* Whitf.	" "
15.	*Natica mediavia* n. sp.	" "
16.	*Natica limula* Con.	118, **232.**
17.	*Natica onusta* Whitf.	" "
18.	*Natica saffordia* n. sp.	" "
19.	*Natica reversa* Whitf.	119, **233.**
20.	*Natica eminula* Con.	" "
21.	*Natica perspecta* Whitf.	" "
22.	*Amaura* (*Amauropsis?*) *tombigbeensis* n. sp.	120, **234.**
23.	*Scala* sp.	" "
24.	*Solariella alabamensis* Ald.	" "
25.	*Pleurotomaria?*	121, **235.**
	Viewed from below.*	
	a. Lateral view.*	
26.	*Fissurella mediavia* n. sp.	" "
	Lateral view.	
	a. Viewed from above.	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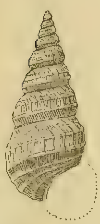
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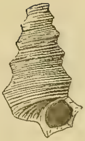
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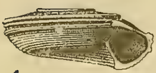
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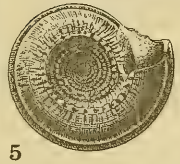
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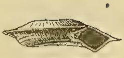
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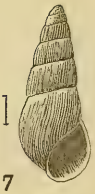
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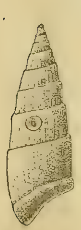
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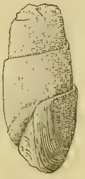
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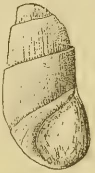
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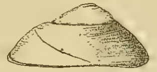
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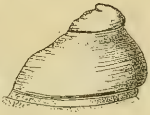
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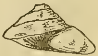
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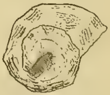
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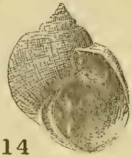
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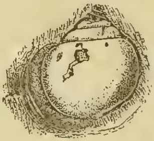
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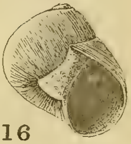
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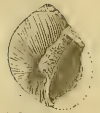
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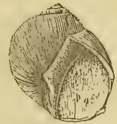
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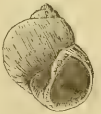
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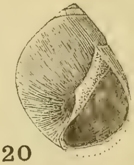
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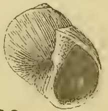
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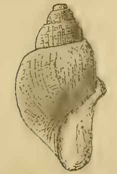
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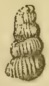
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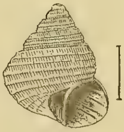
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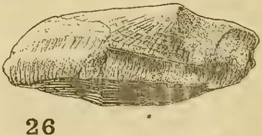
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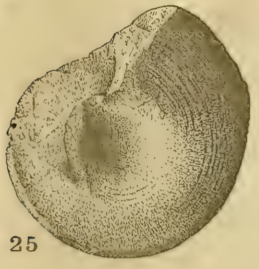
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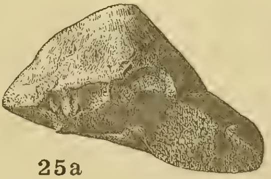
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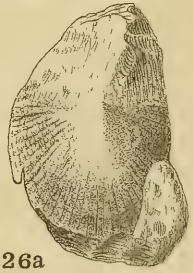
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PLATE 13.

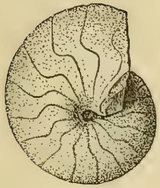
EXPLANATION OF PLATE 13.

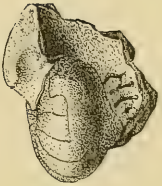
(23)

Page.

Endimatoceras ulrichi White.................................... 122, **236.**
Lateral view of adult, and two views of a young specimen. (Types).

NOTE.—This and the two following plates are from Bull. 4, U. S. Geological Survey.





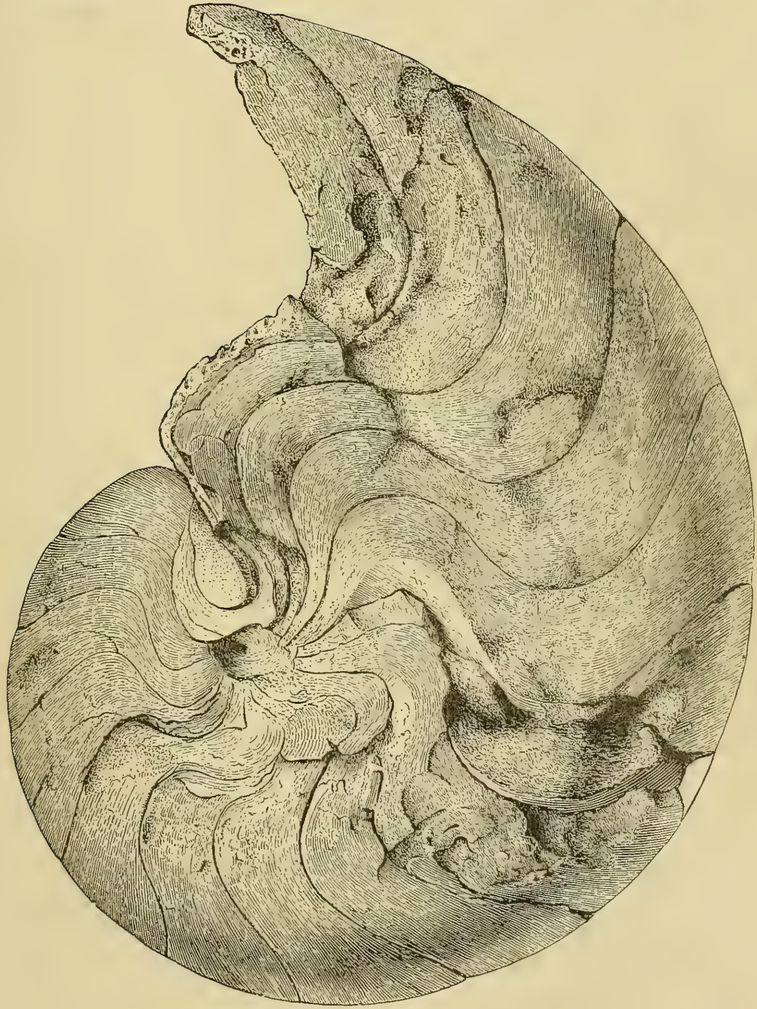


PLATE 14.

EXPLANATION OF PLATE 14.

(24)

	Page.
Enclimatoceras ulrichi White................................ Front view.	122, **236.**

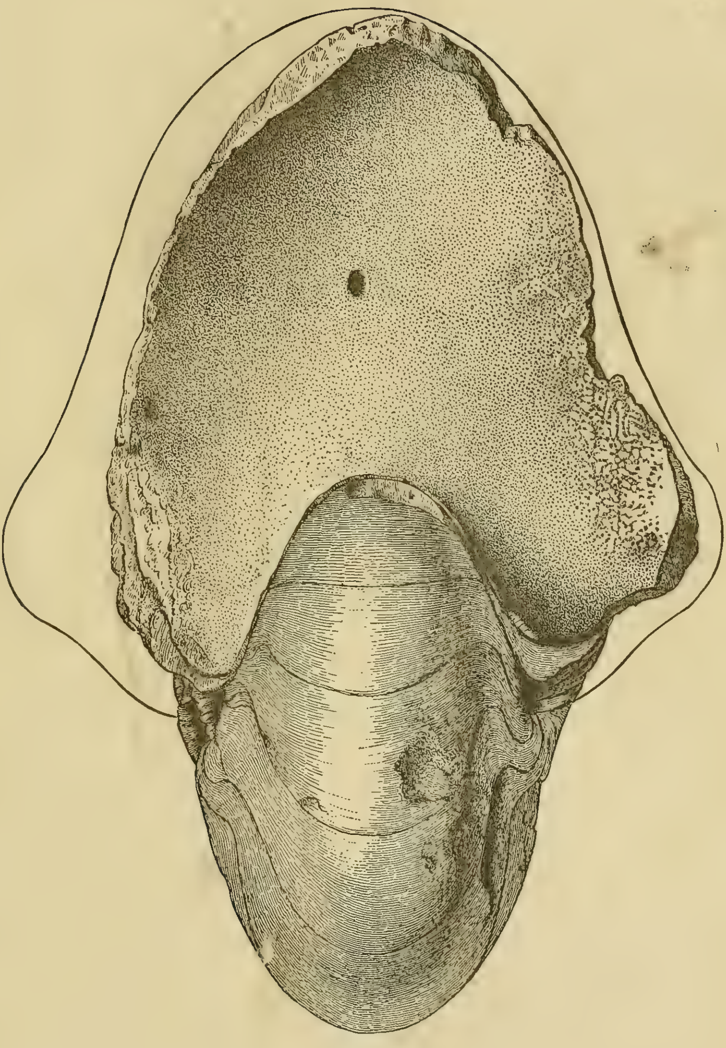


PLATE 15.

EXPLANATION OF PLATE 15.

(25)

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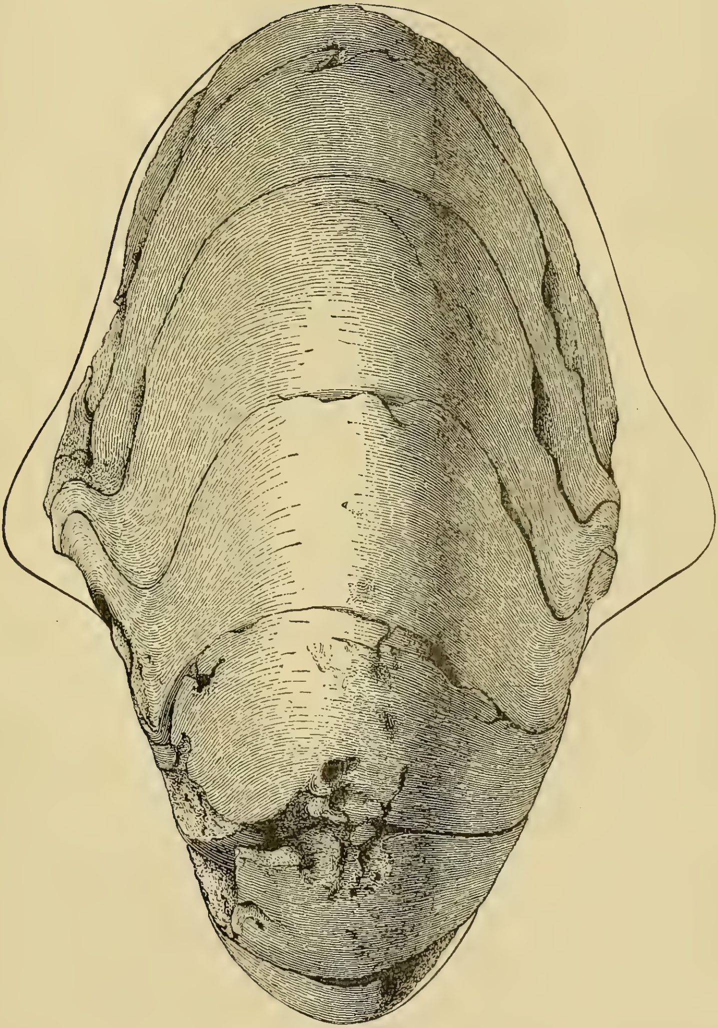
Enclimatoceras ulrichi White.................................. 122, **236.**

Back view.



ERRATA.

While this work has been passing through the press, the following typographic errors have been noted, none of which, it will be observed, materially affect the phrases in which they occur:—

Page 34, 12th line from bottom: volutious for volutions.
94, 3d paragraph: perculiar for peculiar; specimems for specimens.
104, 1st line: *compressa* for *compressus.*
106, 9th line: *gainesensis* for *gainesense.*
113, middle of the page: plantion for plantation.

Plate 6, fig. 16: The Photo-Engraving Co. carelessly cut off the line showing the natural size of the shell. It is magnified 3½ diameters.
12, Explanation of figs. 4 & 5 should be followed by †'s; the last *i* in *periscelidium* should be omitted.

Vol. I

BULLETINS
OF
AMERICAN PALEONTOLOGY

* * *

No. 5

A REPRINT OF THE PALEONTOLOGICAL WRITINGS OF THOMAS SAY;
WITH AN INTRODUCTION

BY

G. D. HARRIS

December 7, 1896

Cornell Univ., Ithaca, N. Y.
Harris Company

onian Institu
JAN 19 1910
National Museum

A REPRINT OF THE PALEONTOLOGICAL WRITINGS OF THOMAS SAY;

With an Introduction by G. D. Harris.

INRTODUCTION.

For several years past we have been endeavoring to decide upon the most feasible plan for rendering the paleontological literature of America, especially that from 1800 to 1860, more accessible to young students. Digests of the paleontological work of each decade have been thought of; reprints of the paleontological matter in each periodical, transactions, or journal have been considered, but not favorably. All digests, adaptations or condensations of works dealing with the systematic side of natural history have seemed but delusions, and fraught with grave dangers; for, what two persons would cull out the same passages as worthy of going into a digest of an author's writings!—the author alone knew just what he wanted to say and how to say it.

Surely, no scholar will ever rest contented with an abridged form of any author's works; he must have the real thing. But if the real thing is beyond his means and there are no magnificent libraries to which he has access, what is he to do? There seems to be but one really satisfactory solution to the difficulty, *viz.*, a republication of each author's work, exactly as he wrote and punctuated it, word for word, line for line, page for page, and plate for plate, regardless of the publication in which it first appeared.

The present Bulletin contains the paleontological writings of one of America's greatest naturalists, and may well serve as an initial number to the many of its kind we hope from time to time to be able to bring out. Doubtless some will believe that it is means thrown away to republish these short and seemingly unimportant articles. Yet we believe such not to be the case. More than once have our European co-workers overlooked Say's original description of *Exogyra* and credited the genus to Sowerby; too often has Say's work on "Crinoidea" been forgotten.

Again, we have paid a dollar for a very poor and shattered set of merely the plates herein republished.[*] Upon the whole, then, it would seem that the desirability of this republication cannot well be questioned.

From our introductory statement, it must not be hastily inferred that paleontological writings from 1800 to 1860 only are difficult to obtain. On the contrary, some important articles published in State survey reports or in the proceedings of societies as late as 1885 or later are now out of print and very hard to obtain. These must sooner or later be printed again or the advancement of paleontological science will be seriously impeded.

Original investigations, if well directed and thoroughly made, are sure of receiving their merited praise, and are indeed, helpful to science. The humble task of republication has fewer attractions, but who can point out the way in which the study of paleontology can be forwarded more than by making its literature accessible, at a very moderate cost, in a most convenient form?

List of Say's Writings herewith Republished.

Fossil Zoology, &c.......... 5–11
Am. Jr. Sci., 1st Ser., Vol. I, 1819.
Fossil Zoology.......... 12–23
Am. Jr. Sci., 1st Ser., Vol. II, 1820.
Fossil shells found in a shell mass from Anastasia Island...25–28
Jr. Ac. Nat. Sci. Phila., 1st Ser., Vol. IV, 1824.
An account of some of the fossil shells of Maryland..........30–76
Jr. Ac. Nat. Sci. Phila., 1st Ser., Vol. IV, 1824.
Crinoidea..........77–84
Jr. Ac. Nat. Sci. Phila., 1st Ser., Vol. IV, 1825.

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[*] The plates of this Bulletin are photo-engraved from this set. They are about four-fifths the dimensions of the originals.

FOSSIL ZOOLOGY, &c.

ART. XII. *Observations on some Species of Zoophytes, Shells, &c. principally Fossil, by* THOMAS SAY.

IF the following descriptions and notices of some of the animal productions of our country, chiefly fossil, and of which some are but little known, should be found of sufficient interest to occupy a place in the Journal of Science, they are very much at your service for that work.

[A. J. S., 1st Ser., Vol. I, 1819.]

The greater portion of them are extracted, with some modification, from an essay which I read about three years ago, to the Academy of Natural Sciences, without any intention at the time of giving publicity to them. But the rapid diffusion of a taste for geological research, seems to require corresponding exertions on the part of those who have attended to fossil remains, inasmuch as geology, in order to be eminently furnished with every advantage that may tend to the developement of many important results, must be in part founded on a knowledge of the different genera and species of reliquiæ, which the various accessible strata of the earth present. The accessory value of this species of knowledge, in now duly estimated in Europe, as affording the most obvious means of estimating, with the greatest approximation to truth, the comparative antiquity of formations, and of strata, as well as of identifying those with each other which are in their nature similar.

Certainly very little is yet known about the fossils of North America, and very little can be known accurately, until we shall have it in our power to compare them with approved detailed descriptions, plates, or specimens of those of Europe; which have been made known to the world by the indefatigable industry, and scientific research of Lamarck and other naturalists.

America is rich in fossils. In many districts of the United States, vast beds of fossil shells, zoophytes, &c. are deposited, which, for the most part, are concealed from the inquiring eye, offering superficially a mere confused mass of mutilated fragments. These rich repositories must finally be exposed to view, by the onward pace of improvement, and the more interior strata will be unveiled by some fortunate profound excavations, the result of enterprise in the pursuit of gain. The very surface of the country in many regions, is almost overspread with the abundance of casts, or redintigrate fossils, many of which are apparently specifically anomalous, and some generically so. The correct, and only useful mode in which the investigation of our fossils can be conducted, is attended with some difficulty and labour.

The task presumes the knowledge, not only of fossils in all their different states, from the apparently unchanged specimen, to the fragment or section of a cast uninsulably imbedded in its rocky matrix, but it also requires an adequate acquaintance with recent specimens, or those of which the inhabitants are not yet struck from the list of animated beings, in other words those of the present, as well as those of the former world.

Due advantage being taken of the many opportunities which are from time to time offered to us, of obtaining knowledge in this department, will probably be the means of producing a list of American animal reliquiæ, coextensive with that of Europe at the present day. In the present state of the science, however, the correct naturalist will feel it a duty which he owes to his colaborators to proceed with the utmost caution, that he may not add unnecessarily to the already numerous species.

Genus Alveolites, Lam.

Coral lapideous, covering extraneous bodies, or in a simple mass, formed of concentric strata; strata composed each of a union of numerous alveoles, which are very short, contiguous, reticulate, and generally parallel.

Species.

A. glomeratus, alveoles vertical, subequal, oval, or obsoletely hexagonal, much shorter than the diameter, parallel; paries simple; strata numerous, forming a rounded mass. (*Cabinet of the Academy of Natural Sciences.*)

Found often on the coast of North America, cast up by the waves, the animals sometimes still living. Forms masses of various sizes and figures, generally more or less rounded or lobed, and composed of a great number of concentric layers. The number of these strata seems to be regulated in some degree, by the quantity of surface they have to cover. Thus if the nucleus happens to be a small shell, such as the *Naticæ*, *Nassæ*, &c. of our coast, or even the oyster, (*O. virginica*,) clam, (*V. mercenaria*,) &c. the strata are often very numerous;

but on the thoracic plate of *Limulus polyphemus*, having a considerable space over which to extend themselves, the strata are but few, not more than 2 or 3. I have seen the thoracic plate of this animal so entirely covered by the *Alveolite*, as to have the eyes and stemmata concealed so as to be perfectly blind. When composed of a single layer only, it much resembles a *Flustra*, or a *Cellapore* of which the convex surfaces have been removed by attrition. The animal I have not yet examined. The alveoles or cells of a layer, are arranged in lines of different degrees of curvature, obscurely radiating from different centres; these lines are placed side by side, the alveoles alternating with each other throughout the layer in a quincunx manner; the thickness of the paries is somewhat equal to one half of the conjugate diameter of the alveole, the length of which, or thickness of the layer, is scarcely more considerable; but these proportions vary.

The species to which it seems allied, are *madreporacea* and *incrustans*. The former is fossil, and differs in being subramose; the latter forms but a single expansion.

Genus Favosites, Lam.

Coral lapideous, simple, of a variable form, composed of parallel prismatic and fasciculated tubes; tubes contiguous, pentagonal, or hexagonal, more or less angular, rarely articulated.

Species.

F. striata, more or less turbinate; *paries of the alveoles* longitudinally striated within, and fenestrate with minute osculi; *alveoles* with very numerous septæ. (*Cabinet Acad. Nat. Sciences; and Peale's Museum—common.*)

Found fossil in various parts of the United States, at the falls of the Ohio; Genessee, New-York; Pittsburg and Wilksbarre, Pennsylvania; Missouri, &c. &c. but not yet in the alluvial deposit of New-Jersey.

The tubes are generally, partially, or entirely filled with silicious matter, sometimes so completely so, as to resemble in miniature, basaltic columns; when the alveoles are free on the surface, these fossils are known by the name of *petrified wasp-nests*, from the resemblance they bear to the nests of those insects. The silex is usually only infiltrated into the cavities, leaving the substance of the coral in its original calcareous state, but the specimens which are found amongst the rolled pebbles of the Delaware River, near Philadelphia, are completely silicified.

The size varies from one fourth of an ounce, to two hundred pounds or more, and the tubes occur of every intermediate diameter, from the fortieth to one fourth of an inch. It is not common to find any two specimens of like form, they are, however, ordinarily more or less turbinate, but are sometimes depressed or compressed, and the tubes rectilinear or excurved, and of various lengths. The dilated summit is not so much the effect of a gradual enlargement of the tubes, as of the frequent and adventitious interposition of young ones, which of course renders the openings of the tubes unequal. The tubes or alveoles, vary in the same coral, being 5 or 6, rarely seven sided, but the hexagonal form is most common; the interior of a tube is divided into a great number of apartments or cells, by approximate transverse septæ, each of the cells appears to be connected with the corresponding cells of the surrounding tubes, by lateral orifices in the dividing paries; these orifices are minute, inequidistant, orbicular, their margins slightly prominent, and forming from one to three longitudinal series on each side of the tube; each row is separated from the adjoining one by an impressed line. By means of these osculi it seems probable that all the animals inhabiting a common coral, were connected together, or had free communication with each other, but whether by means of a common organ as in *Pyrosoma*, *Stephanomia*, &c. or simply by contact as in the aggregating *Salpa*, &c. we have no means of determining.

The *striata* differs from *Madrepora truncata*, Esper. (*F. alveolata*, Lam.) in not being "extùs transversè sulcata." It seems to be allied to *Corallium Gothlandicum*, Amœn. Acad. v. 1. p. 106, and it is possible it may prove synonymous, or very similar to it, when that species becomes better known;

the latter has been taken for Basalt, and M. Lamarck when describing it, inquires "Est-ce un polypier?" *Madrepora fascicularis*, of Volck. and Parkin. in common with *F. striata* and *F. Gothlandicum*, is distinguished by the transverse septa, a character which induced me to refer the species here described to *Favosite;* they seem therefore to be congeneric, as analogy indicates a participation in the character of osculated paries.

Amongst the great variety exhibited by this species, we have to remark more particularly the following, viz.:

1st. Alveoles perfectly free, that is, destitute of aciculi or lamellæ, the septa wanting, and sometimes the osculi obsolete.

2d. Alveoles filled almost to the summit with the septa, and resembling those combs of the bee-hive which are filled with honey and covered over.

3d. Paries beset with very numerous, interrupted, alternating, transverse lamellæ, which are denticulated at their tips, and project towards the centre with various degrees of prominence and irregularity.

The first variety corresponds with the generic character, and the third approaches the genus *Porites;* yet so unequivocally identical are they, that I have seen them all united in the same mass, and perforated throughout by the osculi. The identity is further obvious by the perfect gradation which renders them inseparable.

With respect to the transverse septa, I think their presence may be accounted for by supposing that as the animal elongates its tube in consequence of an increase of growth, or in order to maintain an equal elevation with the adjacent tubes, (rendered necessary by the origin of young tubes in the interstices) it gradually vacates the basal portions of its tube, and sustains itself at the different elevations. by successively uniting the parietal lamellæ so as to exclude the vacuity. That this is probable, we may infer from a similar procedure on the part of several species of testaceous mollusca. Thus some Linnæan *Serpula* become camerated, and a familiar instance presents itself in the *Triton tritonis*, the animal of which adds successive partitions to the interior of the spire, as that part becomes too strait for the increasing volume of its body. If the above supposition proves correct, the organs of communication which pass through the osculi, can hardly be in common, but must rather connect the animals by simple contact only, otherwise these parts would be broken when the animal changes its place by vacating the inferior part of the tube.

The third variety is then the state of that portion of the tube which is inhabited by the body of the animal, and not yet interrupted by the septæ.

From the above observations, it is evident that this species, and probably the entire genus *Favosite* under which I have placed it, will not arrange properly with the *Tubipores*, *Millepores*, &c. but must be transferred to the *Polypiers Lamellifères* of Lamarck. And if the *Madrepora retepora* of Solander and Ellis, is a true *Porites*, as M. Lamarck supposes it to be from the appearance of its tubes, I should conclude this genus to be very proximately allied to *Favosites*, by that species and the *F. striata* having in common the remarkable character of fenestrated paries. But to this character I should conceive a generic importance ought to be attached, as indicating a differential organization of the artificers. I have no doubt that on close inspection of a perfect specimen, the same character will be found to exist in *F. Gothlandicum*, and possibly also in *F. truncata*, if not in the latter only, it may be proper to separate the genus and to withdraw from *Porites* the forementioned species, retaining to *striata* as specifically essential, the second member of the differential description.

(*To be continued.*)

FOSSIL ZOOLOGY.

ART. IV. *Observations on some Species of Zoophytes, Shells, &c. principally Fossil, by* THOMAS SAY, *of Philadelphia.*

(Continued from Vol. I. p. 387.)

Genus Catenipora, Lam.

Coral lapideous, composed of parallel tubes joined together in vertical laminæ; laminæ anastomosing into a network.

Species.

C. Escharoides, Lamarck, millepora. (*Tubipora catenularia,*) American Acad. vol. 1. p. *Tubipora catenulata*, Gmel. &c. (*Cabinet Acad. Nat. Sciences; and Peale's Museum.*)

[A. J. S., 1st Ser., Vol. II, 1820.]

Fossil in different parts of the U. States, particularly at the falls of the Ohio river and in Ulster County, New-York. From this last locality, Mr. C. W. Peale obtained some fine specimens when digging for bones of the Mastodon.—Has not yet occurred in the alluvial deposit of New-Jersey.

Each tube is divided into numerous cells by transverse septæ, precisely as in the *Favosite.* Mr. Parkinson, in his Organic Remains 2, p. 21, remarks, that minute openings are observable in the sides of the tubes; these are not distinct in the specimen under examination, owing perhaps to its being entirely silicified, though an equivocal appearance justifies the belief of their having existed; and if so, the analogy is very strong with the *Favosites.* A species of *Turbinolia* is implanted in the specimen under examination.

Pentacrinus caput—Medusæ.

Of this very remarkable and rare animal, a specimen occurs in the collection of the Museum of South Carolina; it was brought from the Island of Gaudaloupe by Mr. L'Herminier. This is, I believe, the fourth recent specimen known, of this family of extinct animals: of the two other individuals one is in the French, and the others in British collections.

The well known fossil animal supposed to be of this family, so common near Huntsville and in some parts of Kentucky, and which has been figured and described by Parkinson, cannot be properly arranged under either of the genera. These vary in form and size. I have seen four very distinct varieties, but it is possible they may have belonged to different parts of the same pedicel.

Although this fossil is familiar to the observation of Naturalists, yet it does not appear that any particular name has been appropriated to it, or that it has been assigned to any definitive place in the systems.

From its peculiar appearance, persons who have not devoted their attention, to the affinities of natural objects, have regarded it as a petrified *nut* or *Althea bud*, and from the ambiguity of its characters, or the obliteration of its sculpture, naturalists have hesitated to indicate its family, or kindred generic group.

Parkinson is the first author who has figured and described this animal remain. He refers it to the genus *Encri-*

nus under the name of *Kentucky Asterial fossil*, but at the same time and subsequently, he expresses himself doubtfully, as to the propriety of that arrangement. His specimens were not so perfect as to exhibit the basal articulating radii, and the sutures and ossiculæ were perhaps obliterated, as they were unnoticed.

The examination of numerous specimens, in the collection of the Academy of Natural Sciences, collected by Mr. Samuel Hazard, near Huntsville, affords me an opportunity to corroborate the correctness of that arrangement.

But I am induced to believe, notwithstanding the imperfection of our knowledge of these animals, that the genus as it now stands, needs the reforming hand of the systematist, that it is in reality a natural family, including several perfectly distinct genera of many species, the individuals of some of which, as their remains testify, were immensely multiplied in the ancient world.

Actuated by this conviction, I submit to the decision of Naturalists, the propriety of separating the asterial fossil, from the genus Encrinus, as the type of a distinct genus, under the following name and characters.

Genus Pentremite.

Body subglobular or oblong, elevated upon an articulated trunk ; *pelvis* (Parkinson) pentagonal, more or less abruptly attenuated to the base ; *ambulacra* (Lam.) five, incomplete, radiating from the summit and terminating each side at the angles of the pentagon, each with numerous transverse striæ, a longitudinal indented line, two sutures, and numerous transversed impressed lines, which alternate with a marginal series of oblique pores ; *interstitial spaces* (included between the ambulacra) triangular, equal, with a longitudinal suture ; *apex* perforated by five rounded foramina, and an angulated central one ; *ossa innominata* (Park.) large, rhombic. TRUNK branched? cylindrical, articulated, elongated ; *segments* perforated, articulating surfaces with alternately elevated and depressed radii.

A transient view of the superior portion of this reliquium, presents a considerable resemblance to the Echinii, by the apicial foramina, and by the radiating ambulacra which are somewhat similar to a pentapetalous flower. But an attentive examination of its characters, exhibits its inseparable connection with the family of Encrinites by the analogy of its mode of support, its rectilinear sutures, and the general form of its pelvis or basal portion.

To the base is generally attached, the single superior joint of the trunk or vertebral column ; this joint is short, and is longitudinally divided by three sutures, which radiate from a central foramen ; its inferior articulating surface is orbicular, with numerous marginal radii, and the centre exhibits the opening of the foramen ; at its junction with the ossa innominata it is somewhat trilobate. The ossa innominata are of a rhomboidal form, sometimes pentagonal or subquadrate. The pelvis has the same general form with that of the *Encrinus liliiformis*, but the angles of the pentagon are much more acute, and those parts which Parkinson denominates *ribs*, *clavicles* and *scapulæ* are not distinct.

From the superior angle of each of the ossiculæ of the base, a *suture* ascends, bisecting each of the interstitial spaces, and is divaricated near the tip, so as to give to those triangular spaces, a rhombric termination. Each of the five outer foraminæ, (of which one is invariably much the largest) is the common aperture of two tubes which penetrate to the tips of the ambulacra, immediately beneath the sutures of those parts, and which are not visible but by dissection ; the central foramen is stellate.

The peculiar adaptation of these various parts to each other, may have permitted their independent movement, in order that the animal might assume some form of expansion ; but we are led to suppose that this motion could not have been very considerable, from the relative situation of the sutures. And I may further add, that, as we have no direct proof that this animal did possess the power of expanding, it may be, that the motion of its body was confined to the protrusion of tentacula through the foramina, and perhaps smaller ones through the pores of the Ambulacræ.

This question, however, must remain for the solution of future observers, who may have an opportunity to examine them in situ, and of comparing together their different fragments which may be discovered. All the specimens which I have seen, about sixty in number, are in a perfectly similar collapsed state.

[A. J. S., 1st Ser., Vol. II.]

The several different appearances exhibited by specimens of the *Pentremite* may be thus defined—

1st. *Pelvis* abruptly attenuated, nearly horizontal—
Length from seven tenths to more than half an inch.
Kentucky Asterial fossil, Park. Org. Rem. vol. 2, pl. 13.
This is the most common.

2d. *Body* oblong; *pelvis* gradually attenuated; transverse elevated lines of the ambulacra, grooved—
Length from three fourths to one inch and one fourth.

3d. *Body* subglobular; *pelvis* hardly more attenuated than the superior portion—
Length about one inch—
Less common than the preceding ones.

In Peale's Museum a large specimen of the latter is preserved, of which the sutures, have each a parallel impressed line on each side; this specimen was brought from England by Mr. Reubens Peale, he was informed that it was found in the vicinity of Bath, but the fact is very equivocal.

A specimen of the second variety is in the collection of Mr. B. Say; it was presented to him several years ago under the name of *petrified althea bud*, and was dug up in a garden in the borough of Reading, Pennsylvania.

Mr. Z. Collins informed me that this fossil has been noticed and figured, by Dr. S. L. Mitchell, of New-York, as an *Echinus of the family* (genus) *Galerite*, and also as an *asterite*. See his geological observations in the New-York edition of Cuvier's theory as translated by Jameson p. 363, pl. 8. This figure indicates the above first variety.

Renilla Americana,

Is very common on the coast of Georgia and E. Florida, cast up by the waves.

Perna torta.

This large species of fossil Perna has been discovered at Upper Marlborough, in the state of Maryland, by Mr. J. Gilliams of this city. The hinge portion is very entire, but the anterior part, is more or less broken off, as is the case with those found in Europe and like them the substance of the shell is in a tolerable state of preservation, not having undergone much apparent change, excepting that the lamellary increments are readily separable and very friable, the epidermis also is wanting.

It is the same species of shell as that described and figured by Collini in his Journal p. 10, pl. 6. fig. 1. under the name of *Ostreum polyleptoginglimum;* and also anonymously by Parkinson Organ. Rem. vol. 3. pl.

The teeth of one specimen, in the possession of the Academy of Natural Sciences, are obsolete.

Collini says, it is often perforated by *sea insects;* our specimens are also penetrated, but the cavities are formed by an ampullaceous *Pholas*, which in reality may be the same as those which that author alludes to, by the term sea insects; it may be thus named and described.

Pholas ovalis.

Tube equal, entire and rounded at base, and gradually attenuated towards the anterior termination. *Shell* subovate, dehiscent; *valves* with crowded, acute, elevated, transverse lines, somewhat decussate with longitudinal slightly indented ones, a more conspicuous, longitudinal, indented line before the middle, posterior basal margin smooth; within equal, the posterior basal margin distinguished by a slight undulation.

This is not, strictly speaking, a *Pholas*, inasmuch as it is included in a tube; but in other respects it corresponds very well with the species of that genus, as far as I can judge from incomplete specimens, not having seen the accessory valves. It will not agree with *Teredina* Lam. as its valves are concealed by the tube; by which character it is assimilated to *Fistulana*, but from this genus also, it is distinguishable, by the form of its valves, and most probably, by being destitute of the anterior, crustaceous, branchial appendages or valvules, though it is proper to observe that the anterior extremities of the tubes (which contain these parts in fistulana, teredo, &c.) are deficient in my specimens of *P. ovalis*.

In the somewhat compact earth which was included between two fragments of the valves of the abovementioned *Perna*, were a few interesting shells, some of which are perfectly firm and entire, others, although to all appearance similarly circumstanced, are extremely friable, and even fatiscent. Amongst these I recognized a *Crepidula*, which differs from any I have seen, but is too imperfect to be described. A portion of an obtusely rugose incrassated, *Serpula*. A *Pecten* which does not appear to have attained to its complete growth. A small laminated *Cytherea*, Lam. a *Fissurella* allied to *F. græca*, but immature. A *Turritella*, and fragments of a *Balanus* of considerable size, several specimens of a *Nucula* and of a *Calyptræa*. The two latter may be described as follows.

Nucula obliqua, valves obliquely subtriangular, obsoletely striate transversely, one or two of the striæ more conspicuous, numerous, hardly perceptible longitudinal striæ; anterior and posterior sides forming an acute angle; *umbo* obtuse; *apex* acute; *teeth* angulated, prominent, cavity at the apex of the hinge profound, rather long; basal margin denticulatocrenate.

Greatest length one fifth of an inch.—

Very much resembles *Arca nucleus* Lin. but is a smaller species, and proportionally narrower towards the apex, the hinge teeth are also more prominent and the cavity at the apex of the hinge is proportionally larger.

Calyptræa costata, oval, convex, with numerous slightly elevated, equal equidistant costæ, and crowded obtuse, concentric lines, which are regularly undulated by the costæ; *apex* mamillated inclining to one side; *inner valve* pateliform, dilated, attached by one side to the side of the shell, acutely angulated at the anterior junction, and rounded at the posterior junction, and rapidly tapering to an acute tip, which corresponds with the inner apex of the shell.

Length nearly one inch—

Seems to approach, in its characters to the genus *Infundibulum* of Montf. but from the fatiscent state of the specimens, this cannot be acurately determined. No definite spiral suture is perceptible.

Genus Baculites, Lam.

Shells straight, cylindrical, compressed, slightly conic, divided within into transverse septa, which are sinuous or ramose on their margins and pierced with a siphunculus; siphunculus at one extremity of the longest transverse diameter.

[A. J. S., 1st Ser., Vol. II.]

Species.

1. *B, ovata*, elongated; transverse septa subovate, sixlobed and a smaller one behind; *lobes of the superior faces* of the septa, three on each side, with a minute one between each, dentated at their edges. anterior lobe, (nearest the siphuncle) small not sinuous, second lobe with a single projection each side and sinus at tip, third lobe dilated, with a small sinus each side and more obtuse and profound one at tip, posterior lobe hardly larger than the lateral intermediate ones.

Greatest diameter of the transverse section one inch and one fifth, smaller diameter seven tenths; length of the segment about half an inch.

The specimen is in the collection of Mr. Reuben Haines of this city, it was found on the Neversink hills, in Monmouth County, New-Jersey, it is a cast of three very entire segments, no vestige of the shell remaining. The dimensions are taken from the largest segment.

In point of form this species approaches *B. vertebralis, Lam.* particularly in the curvature of the transverse section, but it is somewhat more obtuse behind; another difference consists in the form of the lobes, which, in that species, as represented by Mr. Desmarest, are less symmetrical, destitute of the lateral processes and of the profound terminal sinus; that species also is very diminutive.

2. *B, compressa*, elongated, much compressed; *transverse septa* oblong-oval narrowed to each end; *lobes* dilated, dentated on their edges, each with from three to five sinuses each side and a very profound one at tip.

This description is taken from two fragments in the collection of the Academy of Natural Sciences, which were brought from the Missouri, one by Messrs. Lewis and Clark and the other by Mr. Thomas Nuttall. As they exhibit the appearance of having been violently compressed by fortuitous circumstances, I have not been able to obtain correct proportional dimensions of the species. But notwithstanding this distortion of form, I have much confidence in placing it next in specific affinity to *B. Knorriana*, Desm. as it has without doubt been naturally a much compressed shell, with the lateral edges not very unlike those of that large and remarkable species; from which, however, it is sufficiently distinct by the much developed form of the lobes.

In these specimens a considerable portion of the shell remains exhibiting its beautiful iridescent colours.

Mr. Nuttall gave me the following account of this species. It occurs in the ancient alluvium of the Missouri, or clay formation, reposing adventitiously on the chalk stratum of this region, and imbedded in the indurated shistose beds, amidst other shells, and in the beds which overlie more or less intimately the Xylanthrax or Surturbrand; they are gradually and regularly acuminated through a length of twelve or eighteen inches, being from three to four inches broad at the base and diminishing to less than half an inch, but a perfect apex or base has not yet been discovered.—They are of frequent occurrence, washed out on the banks of the river, from White river of the Missouri to the Mandans, but at the same time, locally and not uniformly distributed.

Genus Ostrea.

O. convexa, Oval, inequivalve; *inferior valve* remarkably convex, with a longitudinal indented line on one side, slightly auriculated, or rather, angulated each side of the hinge, a longitudinal, transversely wrinkled depression, each side before the hinge; *ligament cavity* oval, placed beneath the apex; *superior valve* suborbicular, flat or somewhat concave, radicated from the apex to the periphery, annual increments strongly marked; *hinge* each side before with transverse rugæ.

Length of the convex valve nearly three inches, breadth two and an half—depth about two inches. Cabinet of the Acad. Nat. Sciences.

A perfect specimen was found by Mr. S. Wetherill near Burlington, N. J. I have since obtained a ferruginated one at Mulliger Hill in the same state. It is remarkable for the great convexity of one of its valves, and by the angles each side of the hinge.—It closely approaches to the genus *Gryphœa;* the lower valve is even proportionably more convex than that of *Anomia gryphœa*, and is also furnished with the indented line or lateral lobe as in that shell, but the umbo is not prominent, the superior valve is as operculiform as that of the shell abovementioned, and indeed, with the exception of the less elevated umbo, it is almost as closely related to *Gryphœa* as the *G. dilatata* of Sowerby.

Genus Exogyra.

Shell inequivalve, inequilateral; *cicatrix* one, large, deeply impressed, subcentral; *inferior valve* convex, attached, umbo spiral, spire lateral, prominent, hinge with two parallel, transverse grooves; *superior valve* discoidal operculiform, umbo not prominent, revolving spirally within the margin, hinge with a single groove on the edge.

E. costata, *apex* lateral, with about two volutions; *inferior valve* convex, costate, transversely corrugated, costæ of the disk somewhat dichotomous, sometimes fornicated; *within*, a single profound cicatrix placed rather nearer to the inner side; *hinge* with two nearly parallel, profoundly excavated grooves, of which the inner one is shortest, and corrugated; *superior valve* flat, slightly concave, destitute of costæ, outer half exhibiting the increments, outer edge abruptly reflected from the inferior surface to the superior, but not elevated above it; *hinge* with a single groove on the edge; *cicatrix* profound.

Length four inches, breadth three and a half.—Cabinet of the Acad. of Nat. Sciences.—Peale's Museum.

This interesting shell is the largest and most perfect of its class, which has yet been found in the Ancient Alluvial deposit of New-Jersey. It is not uncommon. I have seen many specimens. They vary somewhat in the costæ, being sometimes almost antiquated, sometimes nearly smooth. The aged shells became extremely thick and ponderous.

It seems to differ from the genus *Gryphœa* by having been attached, and by the lateral situation of the spire; the hinge grooves also are parallel with the edge, so as to be transverse with respect to the shell, bearing some resemblance to those of some species of *Chama*.

Genus Terebratula.

T. plicata, suborbicular, convex, ten or twelve profound, longitudinal plicæ, the two middle ones of the siphunculated valve, slightly more elevated, and the corresponding ones of the opposite valve, slightly more depressed; two or three more conspicuous incremental lines are continued so as to cross the projecting face of the siphunculated hinge margin, which is but slightly prominent.

Cabinet of the Acad. Nat. Sciences.

This handsome species was found in the New-Jersey Alluvium by Mr. S. Wetherill of Burlington. The folds are somewhat similar to those of *Plicatula plicata*. It resembles the *T. crumena* of Sowerby, in the form of its folds, and in their extending to the beak, but the middle of the front is very slightly elevated, with but two folds, instead of three as in the *crumena*, the sides also have two or more folds, instead of four or more, and the beak is not very prominent.

Belemnites.

These are often found in the New-Jersey Alluvium, sometimes entirely changed into chrystalized blue iron earth, (*Hydrate of iron*, of Judge Cooper.)

Ammonite.

A species of this genus was found in the abovementioned locality by Mr. Wetherill. It approaches nearest to *A. elegans* of Sowerby, but I have not seen a specimen sufficiently entire to determine its species with exactness.

Dentalium.

A species has been found in New-Jersey, near Mulliger hill, by Mr. A. Jessup, which seems to approach nearest to *D. sulcatus*, but as it has only about sixteen equal costæ it is more than probably a new species.

Turritella.

A species of this genus was found by the same gentleman with the preceding, in plenty. It approaches very closely to the *T. conoidea* of Sowerby and is most probably the same species.

I have seen several redintrigrate fossils from the New-Jersey Alluvium, amongst which I may mention a *Cucullaea*, *Lam.* which in general form resembles *C. Glabra*, length about one inch and three fourths, breadth rather more; an *Arca*, about one inch wide; a *Terebratula* which seems to approach nearest to *T. ornithocephala*, *Sowerby;* a large species of *Terebratula* resembling the *F. ovoides* of the same author, excepting that it is very slightly truncated before. I found at Mulliger hill a *Natica* much changed by the ferruginous matter so abundant in that region; length nine tenths of an inch; and also a somewhat distorted impression of a *Mytillus*. Specimens of *Turbinolia*, Lam. often occur in different situations.

Description of a testaceous formation at Anastasia Island, extracted from notes made on a journey to the southern part of the United States, during the winter of 1822 *and* 1823. *By* R. DIETZ.

[READ JUNE 8, 1824.]

Anastasia Island, opposite St. Augustine, along the coast of East Florida, is about 10 or 12 miles from north to south, and about 1½ miles from east to west, and has, perhaps, not more than 10 or 12 feet elevation above the level of the ocean, and is from 2 to 3 miles distance from the shore.

A considerable portion of the northern, and, perhaps, the substratum of the remaining part of the island, is composed of an aggregate of fragments of various shells.

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[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

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By permission of my very esteemed and learned friend, Mr. Thomas Say, I add, as a valuable addition to the above paper, his notes of various shells composing that aggregated mass, viz.

Fossil shells found in a shell mass from Anastasia Island.

1. ARCA *pexata*, nobis. It is not a little singular that this shell, and the six next following, so common on our coast at the present day, should be found here in a fossil state.

2. ARCA *ponderosa*, nobis. This shell also, which is very common in the fossil state, is found recent on the southern coast. But I have not found any fossil specimens so large as a recent one in my cabinet.

3. ARCA *incongrua*, nobis. Several small fragments of a shell, which I believe to have been identical with the recent species of this name, occurred in the mass.

4. ARCA *transversa*, nobis. A tolerably perfect young shell, and many fragments of full sized individuals; but this species is not so abundant as either of the preceding.

5. LUTRARIA *canaliculata*, nobis. Three small portions of

the hinge margin of a species, which I believe to be the *canaliculata.* The greatest part of this shell is so thin, that we are not surprised that it should have been comminuted; we should, however, expect to find part of the umbo and the entire hinge fosset, but no trace of either has as yet been discovered.

6. MACTRA. Numerous fragments of a small species which is probably M. *lateralis*, nobis. All the specimens, however, when perfect, must have been smaller than the average size of those now existing on our shores.

7. DONAX. Fragments of a species of this genus seem to be next, in point of frequency, to those of the ARCÆ, and few were obtained nearly entire; as far as I could judge, by comparison, the species is the same with the D. *variabilis*, nobis. Some of the fragments have not yet altogether lost the fine purplish colour of the inner side of the shell.

8. CREPIDULA. A single specimen, too imperfect to admit of a specific decision.

9. LUCINA. A single, young, and imperfect specimen.

10. ARCA. Besides the species of Arca above enumerated, there are some fragments of another species, probably now extinct upon our coast, or, if still existing, extremely rare. It is possible this may prove to be the A. *candida*, GMEL. as it has intermediate smaller striæ towards the anterior end.

Fragments of several other shells were obtained from the mass, but they were too imperfect to justify even the hazard of a conjecture respecting their affinity. It will be observed that all the species here mentioned are bivalves, not the smallest determinable portion of a univalve was observed: from which circumstance we may conclude that the island is almost exclusively formed of bivalve shells, and chiefly of the genus ARCA.

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In a small mass in the possession of Dr. Hays, I observed a young indeterminable species of the genus NATICA, and two specimens of a small OLIVA, also too imperfect to be determined. A mass in the Philadelphia Museum contains a fragment of NASSA *trivittata*, nobis.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

An account of some of the FOSSIL SHELLS *of Maryland. By* THOMAS SAY. *Read July* 20, 1824.

The following descriptions were made out from specimens in a very large and fine collection of fossil shells which Mr. John Finch obtained with much labour and some expense in Maryland, and which that gentleman with great liberality submitted to my examination. Many of these shells appear to the eye nearly as perfect, in every respect, with the exception of colour, as the recent ones of the coast, and not a few of the bivalves have both valves attached together by the teeth of the hinge; circumstances which indicate an undisturbed deposition from the waters in which they had lived. Respecting the limits which circumscribe this body of shells, the relative situation in which the species are found, &c. we may expect much interesting information from Mr. Finch. I may, however, observe at present, that it seems probable that the formation extends much farther south than might at first be supposed, or that nearly a contemporary one exists in South Carolina. For a knowledge of this fact, I am indebted to Mr. Stephen Elliott, who sent me several shells from near the Santee river, one of which corresponds perfectly with a species in the collection of Mr. Finch.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

TURRITELLA.

T. *plebeia*. Pl. vii. fig. 1. Whorls convex, hardly flattened in the middle, with about twelve revolving elevated striæ, the middle ones alternately somewhat smaller; transverse wrinkles distinct.

This shell seems to attain to the length of rather more than one inch. Several specimens are imbedded in a small mass of light lead coloured clay. It somewhat resembles T. *brevis* of Sowerby, but the striæ are not crenulated. A species of Turritella was found by Mr. A. Jessup in New Jersey, quite different from the present species, and resembling the T. *conoida*, Sowerby, but much smaller.

NATICA.

N. *interna*. Pl. vii. fig. 2. Subglobose, depressed, subglabrous; umbilicus open, with a revolving rib.

Description. *Shell* destitute of revolving striæ, and the wrinkles are not prominent, except near the suture, towards the labrum, and on the verge of the umbilicus: *spire* but little prominent, acute: *aperture* subovate: *umbilicus* open, permitting a view nearly to the inner tip of the spire; a revolving rib above the middle of each volution, terminating at the labrum in a hardly prominent callus.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

Length seventeen-twentieths, breadth nine-tenths of an inch.

Several specimens are in Mr. Finch's collection in tolerable preservation, but very fragile, though not thin. I obtained a species of NATICA at Mullica Hill, New Jersey, a few years since; but it is so changed by casualties, and by the infiltration of ferruginous matter, that its specific alliance with the present species cannot be appreciated.

OLIVA.

Several specimens occur about the length of one inch and two-fifths, but too imperfect to admit of any decision as to the species.

BUCCINUM.

1. B. *porcinum*. Pl. vii. fig. 3. Subovate, acute, slightly undulated, and spirally striated; labrum toothed.

DESCRIPTION. *Shell* with numerous, subequal, slight undulations, disappearing on the body whorl, and about seventeen transverse, little elevated striæ: *whorls* nearly six, but little convex: *suture* very narrow, consisting of a mere indented line: *apex* acute: *aperture* moderate, rather more than half the length of the shell: *labium* covering the columella, concave: *labrum* not thickened; on the inner submargin with striæform teeth.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

Length one inch and a quarter, breadth rather more than three-fourths of an inch.

This is shorter than the *reticosum* of Sowerby, the suture is not so deeply impressed, the undulations are not so obvious, and the concavity of the labium is much more profound.

2. B. *aratum*. Pl. vii. fig. 4. Oblong subovate, spirally striated; labrum thickened and toothed within.

DESCRIPTION. *Shell* with more than twenty revolving, slightly elevated lines: *whorls* but little convex: *suture* very narrow, consisting of a mere indented line: *aperture* moderate: *labium* covering the columella, which is concave: *labrum* thickened on the exterior, and with striæform teeth on the interior submargin.

Breadth half an inch, length of the aperture rather less.

Smaller and of a much more slender form than the preceding, and altogether destitute of undulations. The summit of the spire being deficient in the specimen, its length cannot be ascertained.

FUSUS.

F. 4-*costatus*. Pl. vii. fig. 5. Ovate-ventricose; with a dilated umbilicus, and four much elevated belts, which are more dilated at their tops.

DESCRIPTION. *Spire* short, the volutions with but two belts, the others being concealed by the succeeding whorls: *body whorl* with four belts, which are equidistant, much elevated, wider at top than at the junction with the whorl; and with one or two deeply impressed lines; intervening spaces wrinkled, the wrinkles extending over the belts: *aperture* suboval: *canal* short and contracted: *labrum* with a groove corresponding with each of the exterior ribs: *umbilicus* dilated, large, not visibly penetrating to the inner summit; the exterior margin prominent and deeply dentated.

Varies much in size; the smallest in Mr. Finch's collection is about three-fifths of an inch wide, another is rather more than one inch in width, and the largest is nearly three inches and three-fourths; but a fragment of a still larger one leads me to believe that the species attained to a width of more than four inches. I am unable to state the proportional length, all the specimens having truncated spires. The belts of some young specimens are altogether destitute of the impressed lines.

It seems hardly possible that Lister's figure 2, of plate 1059, was intended for this shell, although it has certainly a general similarity in the ribbed appearance of the figure, and notwithstanding the locality "*a Marylandia*," which is engraved with it, inasmuch as there is not any appearance whatever of an umbilicus, which is so much dilated and so remarkable in the species under consideration.

Lister's figure is quoted by several authors amongst the synonymes of BUCCINUM *scala*, and considered as a variety of that shell, which may perhaps be correct; but in that case the fact of such a shell having been found in Maryland, is at least doubtful. Our shell may be the same with the species which Dillwyn informs us is mentioned in the Portland Catalogue, lot 3516.

A fine specimen of this shell was sent me some time since by Mr. Stephen Elliott of Charleston, who informed me that it was found with other interesting and perfect shells which accompanied it, on the Santee river, a little below the junction of the Congaree and Wateree rivers.

FUSUS *cinereus* nobis. A variety of this shell is in Mr. Finch's collection; it differs but little from the recent shells, the spire and beak are slightly longer.

FULGUR.

1. F. *canaliculatus*, Linn.

Lister Conch. pl. 878, f. 2.

Ellis' Coral. pl. 33, f. b. As this latter figure has the channel of the spire, and is accompanied by the ovaries of the *canaliculatus*, it is, no doubt, the young of this shell, reversed by an error of the engraver as Dillwyn has already supposed.

VARIETY. Sutural channel dilated, columella much arcuated.

With the exception of the variation above mentioned, the specimen agrees very well with the species to which I have referred it. The granulations which crown the spire of the young shell are very evident in this specimen. These elevations characterize the MUREX *granum*, Schrœter, which Linné considered to be the young of this species.

2. F. *carica*, Gmel.

Lister, Conch. pl. 880.

F. *eliceans*, Montf. p. 152. Knorr delic. pl. 30. f. 1.

There can be no doubt of the identity of a specimen collected by Mr. Finch, with this species.

The *carica* varies considerably in the magnitude and number of the elevations which constitute the armature of the shoulder. In the young shell they are more numerous than in the adult, and the beak is proportionally longer and more slender. A variety in this fossil collection has the elevations of the shoulder hardly prominent.

CALYPTRÆA.

1. C. *grandis*. Pl. vii. fig. 6. a. Internal view. b. Lateral view. Ovate; internal appendage dilated, and attached to the side of the shell.

DESCRIPTION. *Shell* large, ovate at base, inequilateral, concentrically wrinkled, destitute of spines or processes: *apex* behind the middle nearly erect: *internal appendage* transverse, patulous, occupying a considerable portion of the cavity of the shell, and attached by one side, from its summit to its edge, to the shorter side of the shell; its summit corresponding to the inner apex of the shell.

This very remarkable shell is perfectly distinct as a species from any other yet known. That it does not, in rigid accuracy, belong to the genus CALYPTRÆA, must be evident to every conchologist who considers the characters laid down in the above description, and who is, at the same time, aware, that the internal appendage of the type of the genus, is open on one side throughout the whole of its length. If it be not properly a CALYPTRÆA, it cannot be referred to the closely related genera INFUNDIBULUM, Montf. and MITRULA of Gray, much less to any other genus with which we are acquainted. I therefore propose that it be placed in a new genus under the following name and characters.

DISPOTÆA.

Shell univalve, conoidal, patelliform, with an internal entire cup-shaped appendage, adhering by its side and apex to the side of the shell.

To this genus will also be referred a recent species brought by Lieut. Gantt, U. S. N. from South America, and presented by him to the Academy. Of this shell I cannot find any description, and will therefore characterize it as follows:

D. *tubifera*. *Shell* oval, inequilateral, with small radiating striæ, and numerous tubular processes: *apex* inclinde towards the shorter side; within livid-brown, polished: *cup-shaped appendage* brown near the apex, margin pure white, and distinct from the side as far as the submargin.

CALYPTRÆE *costata*, nobis, Silliman's Journal, vol. 2, p. 40, belongs to this genus. In Mr. Finch's collection are fine specimens of this species.

FISSURELLA.

F. *redimicula*. Pl. viii. fig. 1. Ovate-oval a little oblong, conic-convex, with approximate longitudinal striæ; foramen ovate-oval, inclined.

DESCRIPTION. Longitudinal striæ slender, numerous, granulated, approximate; the granulations of the striæ give the appearance of concentric obsolete lines: *aperture*, inner margin crenate; thickened inner margin of the foramen truncate at one end.

Longest diameter one inch and a half.

I am not acquainted with the F. *peruviana*, Lam. and the description of that shell will not enable me to judge satisfactorily of its degree of affinity with the present species.

OSTREA.

1. O. *compressirostra*. Pl. viii. fig. 2. a. Internal view. b. External view. *Shell* sinistral,

subovate: *inferior valve* convex, with numerous convex ribs interrupted by fornicated scales at the lines of increment; *hinge* curving a little upward, very much contracted and short: *superior valve* flat, wrinkled concentrically, without any appearance of longitudinal lines: *hinge* more dilated than that of the superior valve, and oblique with respect to the thickness of the shell.

Length of the specimen four inches and four-fifths; breadth four inches and a quarter. A large superior valve is five inches and three quarters long, and five inches and a quarter broad.

Like many species of this genus, it varies much in form, and in the prominence of the ribs on its convex valve; but these ribs are very obvious on the nine specimens under examination. Externally some varieties have a striking resemblance to O. *bellovacina*, Lam. but the hinge is much more contracted.

Besides those obtained by Mr. Finch, Mr. Z. Collins presented a fine specimen to the Academy, found on the west branch of the Potomac, about fifteen miles below Alexandria.

PECTEN.

P. *Jeffersonius*. Pl. ix. fig. 1. Subequivalve, with from nine to eleven striated ribs.

DESCRIPTION. *Shell* rounded, convex, not quite equivalved, one of the valves being a little more

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convex than the other; the whole surface covered with approximate, scaly striæ: *ribs* elevated, rounded, with six or seven striæ on the back of each; intervening grooves profound: *ears* equal: sinus of the ear of the superior valve, not profound, being barely one eighth part of the length of the ear: *within* with broad rounded flattened ribs.

Length five inches and three-tenths, breadth five inches and seven-tenths.

Specimens of this truly fine shell are not uncommon. The Academy has been long in possession of several single valves, in an excellent state of preservation, obtained by my friend Mr. J. Gilliams, and others which were presented by Mr. Watson, who purchased them at the sale of the collection of the late Professor Barton. Mr. Finch has succeeded in obtaining entire specimens of the two valves of the same individual. I am of the opinion that Lister's plate 167, is intended to represent this shell, and that the singular appearance of the marginal striæ in that figure is a deviation from the ordinary formation of the species, and is owing to the dislocation of the lines of increment, and obliteration of the longitudinal striæ. Lister describes his specimens to be of a "blue-clay colour," in this respect perfectly corresponding with two specimens before me.

On one of the specimens is an imperfect ASTREA.

2. P. *Madisonius*. Much compressed, with about sixteen striated ribs.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

DESCRIPTION. *Shell* rounded, much compressed; the whole surface covered with scaly striæ: *ribs* elevated, rounded, with about three striæ on the back of each; intervening grooves rather profound: *ears* equal, sinus of the ear of the superior valve profound, extending at least one third of the length of the ear.

Length rather more than four inches and a half; breadth four inches and four-fifths.

In magnitude this shell is justly entitled to compare with the preceding; but it differs in being much less convex, and in having a much more profound sinus in the ear of the superior valve. Three specimens, from which the above description was taken, belong to the Academy, and were presented by Mr. Watson.

3. P. *Clintonius.** Pl. ix. fig. 2. Auricles equal; surface with from one hundred and forty to one hundred and eighty elevated longitudinal lines.

DESCRIPTION. *Shell* suborbicular, compressed, with very numerous, regular, elevated striæ, which are muricated with minute scale formed by transverse wrinkles, that are sparse in the middle of the length, and crowded each side of the shell; the intervening spaces are regularly concave, and in parts very distinctly wrinkled: *auricles* equal, striated like the general surface : *within* simple, margin striated.

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* Mr. Finch requested that three species of his collection that might prove to be new, should be dedicated to the distinguished men whose names these shells bear.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

Length four inches ; breadth rather more.

This is a very fine shell, comparable with the *magellanica ;* but the sides below the auricles decline much more rapidly towards the base, and the striæ, judging from Bruguiere's figure, are much more prominent and distinct.

4. P. *septenarius*. Pl. ix. fig. 3. *Shell* convex, suborbicular : *auricles* subequal : *surface* with numerous slightly scaly striæ, and about seven remote ribs, of which the three intermediate ones are much elevated, rounded, or slightly flattened on the top.

Length nearly two inches and seven-tenths.

But a single imperfect, inferior valve, occurs in Mr. Finch's collection ; but this is so perfectly distinct from any other that I have seen described, that I have no hesitation to describe it as new. The striæ are equally distinct on the ribs, and in the intermediate spaces. The scales are rather thick, very small, and not confined to the striæ, but are also observable in the spaces between the striæ.

PLICATULA.

P. *marginata*. Pl. ix. fig. 4. a. External view. b. Internal view. Shell ovate-cuneiform, somewhat arcuated at base ; with about three much elevated folds, producing very profound undulations on the edge of the shell; the intermediate fold is bifid; the whole surface is marked by rather gross concentric wrinkles; inner margin dusky or blackish, with a series of granules on one valve, received into corresponding cavities in the opposite valve.

Length one inch and a fifth, breadth one inch.

This species is very distinct from the P. *plicata*, Linn. of the West Indies, and from that of the East Indies, hitherto confounded with the *plicata*, but to which Lamark's name of *gibbosa* may be transferred.

Of the known fossil species, it seems to approach nearest to the *angulata*, Lam. but the folds are neither squamous nor angulated.

ARCA.

1. A. *arata*. Pl. x. fig. 1. Shell transversely oblong, subrhomboidal, with about twenty-six longitudinal ribs; basal edge nearly parallel to the hinge margin, which latter terminates anteriorly in an angle.

DESCRIPTION. *Ribs* somewhat flattened, as wide or rather wider than the intervening spaces; the whole surface concentrically wrinkled: *umbones* not remarkably prominent: *apices* remote, the intervening space rhomboidal, with continued indented lines, arcuated under the apices: *hinge* *margin* perfectly rectilinear, angulated at the extremities, the anterior one a little projecting : *teeth* in a continued, uninterrupted line, parallel, excepting at the two extremities of the line, which decline a little, and the teeth are there decidedly longer and oblique with respect to the others of the range : *posterior end* obliquely rounded to the base : *base* nearly rectilinear and parallel to the hinge margin, and deeply crenated on the inner margin : *anterior end* produced below the middle, and rounded, and a little contracted near the superior angle.

Length from the hinge margin to the base one inch and three-tenths, breadth two inches and a half.

This resembles a species found recent and very common in the West Indies, and which I have not ascertained to be distinctly described. That shell, however, is proportionally longer, the anterior extremity only of the line of teeth declines a little, and the series is slightly dislocated a little before the apices of the shell.

2. A. *centenaria*. Pl. x. fig. 2. Shell transversely-oval, subrhomboidal, obtusely contracted at base, with numerous alternate longitudinal striæ.

DESCRIPTION. Striæ from one hundred to one hundred and eighty and more in number : disappearing on the hinge margin ; with hardly obvious transverse minute wrinkles, and larger, remote, irregular ones of increment : *beaks* but little prominent, not remote: base widely but not deeply contracted, nearly parallel with the hinge margin: *anterior* and *posterior margins* obtusely rounded: *series of teeth* rectilinear, uninterrupted, decurved at the tips; space between the beaks with numerous grooves proceeding from the teeth: *inner margin* not very distinctly crenated: *muscular impressions* elevated, and forming a broad line each side, from the cavity of the beak to the margin.

Length nine-tenths of an inch, breadth nearly one inch and a half.

3. A. *incile*. Pl. x. fig. 3. Shell transversely rhomboidal, with about twenty-seven ribs; anterior hinge margin compressed and angulated.

DESCRIPTION. *Disk* prominent from the beaks to the anterior part of the base: *ribs* with transverse granules; those anterior to the middle alternating with very slender and but little prominent lines, and with a groove on each: *anterior margin* longer to the base than the posterior end, and contracted in the middle: *series of teeth* nearly rectilinear, entire; interval between the teeth and the apices with a few transverse lines or wrinkles; a single oblique groove from the apex to a little before the middle, and six or seven narrow ones from the teeth outwards behind the apices: *beaks* placed very far backward: *inner margin* crenated: *muscular impressions* a little elevated, posterior one short: *basal margin* not parallel with the hinge margin.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

Length nearly seven-tenths of an inch, breadth less than one inch and a fifth.

PECTUNCULUS.

P. *subovatus.* Pl. x. fig. 4. Longitudinally short ovate, with about thirty longitudinal impressed acute lines, the intervals a little convex.

DESCRIPTION. *Shell* increasing in width by a slightly curved line from the apex to beyond the middle: *lateral curvatures* equal: *apices* separate, small, central; intervening space with but little obliquity to the plane of the shell, with obsolete angulated lines: *teeth* forming a regularly and much arcuated series, which is rectilinearly truncated above so as to leave in that part a mere edentulous elevated line: *within* destitute of striæ: *margin* with elevated angular lines: *exterior surface* with about thirty longitudinal, impressed, acute lines, the intervals a little convex.

Length from the apex to the base one inch and thirteen-twentieths, breadth one inch and a half nearly.

The character of the interval between the beaks is not unlike that of a CUCULLÆA, but the arrangement of the teeth does not correspond with the definition of that genus.

This shell varies a little in form, being sometimes nearly orbicular.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

NUCULA.

1. N. *lævis.* Pl. x. fig. 5. Transversely elongate-subovate, rostrated, nearly smooth.

DESCRIPTION. *Shell* compressed, thin, fragile, polished, smooth, slightly wrinkled towards the base : *beaks* nearly central, hardly prominent beyond the hinge margin, rounded, approximate : *series of teeth* subrectilinear, a little arcuated behind ; teeth prominent : *hinge margin* exteriorly both before and behind the beaks rather abruptly compressed : *posterior margin* rounded : *anterior margin* somewhat rostrated, the anterior hinge margin rectilinear, very little reflected at tip : *inner margin* simple.

Length nearly half an inch, breadth nearly one inch.

This shell may be compared with the N. *pellucida*, Gmel. but it is shorter, in proportion to its width, and the beaks are nearer the centre. It is still more closely allied to a recent species of our coast, that has probably been hitherto considered as the *rostrata.*

2. N. *concentrica.* Pl. x. fig. 6. Transversely elongate-subovate, rostrated, concentrically striated.

DESCRIPTION. *Shell* convex : *rostrum* considerably narrowed towards the tip : *surface* concentrically striated with numerous, regular, equidistant, rounded lines: *beaks* rather behind the middle: *ligament margin* a little concave: *series of teeth* angulated at the beaks.

Length over one-fifth, breadth two-fifths of an inch.

The regularly striated surface gives this shell a very pretty appearance. In outline it has some resemblance to the *rostrata*.

VENERICARDIA.

V. *granulata*. Pl. xii. fig. 1. Suborbicular, with about twenty-five convex ribs, and wrinkled across; inner margin crenate.

DESCRIPTION. *Beaks* nearly central, a little prominent, curved backward: *ribs* granulated on the umbones, and transversely wrinkled near the base, convex: *apices* somewhat prominent beyond the general curve of the shell: *inner margin* and *edge* crenate: *cardinal* teeth two.

Length from the apex to the base four-fifths of an inch, breadth nearly the same.

Rather proportionally longer than the *decussata*, and more oblique.

CRASSATELLA.

C. *undulata*. Pl. xi. fig. 2. a. External view. b. Internal view. Much compressed, transversely oblong-subovate, slightly angulated before; surface rather coarsely wrinkled, and on the umbo with small, regular undulations ; umbo flattened : *apex* subacute, not prominent, placed a little behind the middle of the shell : *hinge* teeth distinct, prominent : *fosset* much dilated ; a profound groove on the anterior inner margin : *edge* not crenated ; on the exterior anterior margin and submargin are two undulations, of which the former is less distinct and more acute.

Width rather less than one inch and nine-tenths to four inches and three-fifths, length less than one inch and three-tenths to about three inches.

The species to which this is most closely allied, is the *compressa*, Lam. Its compressed form, and the somewhat elevated lines on the anterior part of the shell, seem to be very similar ; but that species is proportionally much broader behind, the beaks are much nearer the posterior extremity, and the inner edge is crenated. A perfect valve was purchased at the sale of the late Professor Barton's collection by Mr. Watson, and by him presented to the Academy. Its locality was not known, but a fragment which I dissected out of a mass containing fragments of PERNA, belonging to the collection of Mr. Finch, has decided this question.

ISOCARDIA.

I. *fraterna*. Pl. xi. fig. I. a. Hinge 2. b. Back view. Cordate-globose, slightly oblique, with rather large concentric wrinkles, and lines of growth ; an elevated undulation on the anterior submargin, marking the greatest length of the shell : *umbones* not very prominent, apex rather suddenly incurved, acute ; impressed space behind the beaks, dilated and rather profound ; anterior tooth striated externally, and placed on the middle of the anterior margin.

Large specimen, greatest length taken obliquely, three inches and a half, breadth rather less.

Small specimen, greatest length rather over one inch and a half, breadth nearly one inch and four-fifths.

This shell is so much like the VENUS *rustica*, Sowerby, that I hesitated to give it a distinct name. Besides being somewhat less transverse, it may be remarked that the hinge groove, behind the primary tooth, is much more elongated ; but notwithstanding these differences, such is the general correspondence of the two shells, that I should not be surprised if this should prove to be only a variety of the *rustica*.

A large specimen which formerly belonged to the collection of the late Professor B. S. Barton, was presented to the Academy by Mr. Watson. A smaller one was obtained by carefully dissecting one of the friable masses containing fragments of the Perna, in Mr. Finch's collection.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

TELLINA.

T. *æquistriata.* Pl. x. fig. 7. *Shell* transversely ovate-orbicular, with an elevated line or fold on the anterior margin : *surface* with fine, somewhat elevated, concentric, nearly equal, numerous striæ, forming grooves between them : *apex* nearly central, acute : *cardinal teeth* deeply grooved : *lateral teeth* two ; edge within, simple.

Length seven-tenths, breadth nineteen-twentieths of an inch.

In general outline, this species has a resemblance to T. *ostracea*, Lam. In one specimen the apex is central, and in another it is placed before the middle.

LUCINA.

1. L. *contracta.* Pl. x. fig. 8. *Shell* convex, suborbicular, with numerous concentric, regular, equidistant, elevated, membranaceous striæ, and intermediate smaller transverse lines : *umbones* not very prominent : *apices* proximate, nearly central : *anterior hinge margin* rectilinear, to an obtuse angle near the middle of the anterior margin : *anterior submargin* with a very slightly impressed line : *posterior margin* rounded : *cardinal teeth* one in the left valve, and two in the right, the posterior one of which is subbifid at tip : *lateral*

teeth none : *within* obsoletely striated towards the margin : *posterior muscular impression* perfectly rectilinear, elongated, and oblique.

Length one inch and nine-tenths, breadth two inches and one-tenth.

The posterior muscular impression is even more elongated and slender than that of L. *jamaicensis*, Chemn. In outline it is like L. *scabra*, Lam. The impressions both before and behind the beaks are very slender and contracted. A young specimen belonging to the Academy, was brought from Maryland by Mr. Jacob Gilliams.

2. L. *anodonta*. Pl. x. fig. 9. Orbicular, slightly transverse, compressed ; teeth obsolete.

DESCRIPTION. *Shell* with elevated wrinkles ; orbicular, a little transverse, with a very slight impressed longitudinal line on the anterior margin : *anterior* and *posterior ends* equally curved : *apices* not prominent beyond the general curve of the shell, with a very short deep emargination behind them ; *teeth* obsolete ; both the cardinal and lateral ones are generally altogether wanting : *lunule* short, cordate, profound.

Length from the apices to the base one inch and one-tenth, breadth one inch and one-fifth.

The impressed line on the anterior part of the shell is hardly visible in many specimens, and is sometimes only a very slight undulation, not observable but on close inspection. In the specimens, the ligament of the hinge still remains, apparently but little changed; by pressure of the nail it is readily separated into flaxy filaments.

3. L. *subobliqua*. Orbicular, slightly oblique, a little compressed; teeth prominent; lunule not distinct.

DESCRIPTION. Shell concentrically wrinkled; a little oblique forwards, the most prominent part of the basal curvature being anterior to the middle; no appearance of an impressed line on the margins, which are rounded, the hinge margin being rectilinear for a short distance: *lunule* none, or consisting only of a slightly impressed line: *beaks* slightly prominent: *muscular impressions* dilated, submarginal: *cardinal teeth* prominent, the larger one with a groove: *lateral teeth* none.

Length four-fifths of an inch, breadth nearly the same.

4. L. *cribraria*. Pl. xiii. fig. 1. Orbicular, convex, with numerous longitudinal costæ, and distinct elevated concentric lines.

DESCRIPTION. *Shell* with close set, longitudinal, equal, granulated ribs, and more or less elevated, distinct, concentric lamellæ: *hinge margin* obtusely and not prominently angulated at its anterior and posterior terminations: *anterior margin* with a dilated slightly impressed, and not very obvious groove: *lunule* oblong-oval, very distinct, the edge near the beaks extending inwards beside the primary teeth: *lateral teeth* very distinct, the posterior one placed nearly under the middle of the

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lunule : *within* crenate on the edge : *posterior muscular impression* rectilinear.

Length half an inch, breadth eleven-twentieths of an inch.

Two or three smaller specimens are two-fifths of an inch long. In the outline of the edge, and number of the costæ, this species approaches the L. *scabra* of authors ; but it is more convex, and in other respects sufficiently distinct. In the larger specimens, the transverse lamellæ are almost obsolete at base, and the ribs prevail in that part.

L. *divaricata*. Var. The fossil specimens of Maryland are altogether similar to those found at present in a recent state on our southern coast. This variety is smaller than those of South America and the West Indies, and the lateral teeth are more obvious. In the collection of the Academy is a large specimen of the *divaricata* from the West Indies, that agrees with the description of the *dentata* of Wood. I should therefore be inclined to suppose, that the *dentata* is no other than a variety of the former, owing to age.

VENUS.

1. V. *deformis*. Pl. xii. fig. 2. a. View of the hinge. Shell remarkably thick and ponderous, longitudinally undulated ; basal margin undulated.

DESCRIPTION. *Shell* subcordate, with transverse wrinkles, which are distant and regular on the umbones, and much crowded on the basal half; several very obtuse longitudinal undulations, of which that on the middle is more profound: *basal margin* deeply undulated in compliance with the undulations of the disk: *within* crenate on the edge: *anterior margin* flattened, and simply wrinkled.

Length nearly five, breadth six inches.

Smallest specimen, three inches and seven-tenths long, and four inches and a half wide.

This extraordinary shell has so unusual an appearance, that I should almost have been disposed to regard a single specimen as a monstrosity. The examination of several individuals proves that the species varies somewhat in form, and in the locality of the undulations.

2. V. *paphia?* Lam.

CYTHEREA.

C. *convexa*. Pl. xii. fig. 3. *Shell* subcordate; elevated convex, concentrically wrinkled, inequilateral; posterior tooth and fosset not striated; edge not crenated; umbo rather prominent; lunule dilated, cordate, marked by a simple line.

Length one inch and a tenth, breadth more than one inch and three-tenths.

On the inner surface of the shell is a prominent line in one valve, proceeding from the extremity of the impression of the retractor muscle, and becoming obsolete behind the cavity of the umbo; on the opposite valve is an impressed line, occupying a similar position. Whether or not this line is characteristic, I am unable to determine, having seen but two valves.

C. *concentrica.* Born. Mr. Finch's differ from those now existing on our southern coast, in being larger.

Length three inches and three-tenths, breadth three inches and two-fifths.

ASTARTE, *Sowerby.*

1. A. *undulata.* Pl. ix. fig. 5. Shell trigonate, umbones flattened, and with profound undulations; apices very acute.

DESCRIPTION. Basal half of the shell coarsely wrinkled, the remaining half deeply, regularly and widely undulated on the flattened umbo: *lunule* large oblong subovate, concave, separated from the disk, particularly near the beaks, by an acute angle: *beaks* prominent, approximate, acute, turned a little backward at tip: *ligament margin* concave nearly to the basal angle, and separated from the disk, near the beaks, by an acute angle: *ligament* very short: *teeth* regularly crenated each side: *basal angles* rounded: *basal edge* nearly rectilinear, or very obtusely arcuated; within finely crenated; smaller muscular impression very distinct.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

Length four-fifths, breadth rather less than nine-tenths of an inch.

Var. a. Length one inch and a tenth, breadth one inch.

A very distinct species, unlike any other yet described. It varies in proportional length, some being longer than broad, and others broader than long. I adopt Sowerby's generic name, in preference to that of CRASSINA of Lamarck, for the all-sufficient reason, that it has the priority. The recent shell which I described under the name of VENUS *castanea*, Journ. Acad. Nat. Sc. vol. 2. p. 273, belongs in strictness to this genus.

2. A. *vicina*. Pl. ix. fig. 6. Trigonal with a distant, somewhat regular, impressed line: lunule much excavated; apices acute.

DESCRIPTION. *Apices* prominent: *lunule* dilated, deeply excavated, subcordate, separated from the disk, particularly near the beaks, by a subacute angle: *beaks* prominent, approximate, acute, curved backwards: *ligament margin* concave: *umbones* convex.

Length nine-tenths of an inch, breadth one inch.

Closely allied to the preceding, but numerous specimens correspond in the much more profoundly concave lunule, and in the convexity of the umbones.

MACTRA.

Two or three mutilated specimens of a species closely allied to M. *lateralis*, nobis, but too imperfect to determine the degree of proximity.

AMPHIDESMA.

A. *subovata*. Pl. x. fig. 10. Shell transversely ovate-oval, with somewhat prominent and regular concentric striæ.

DESCRIPTION. *Shell* compressed : *beaks* rather before the middle, but little prominent : *anterior* submargin with an obsolete, obtuse undulation : *lunule* lanceolate : *cardinal* and *lateral teeth* prominent.

Length seven-tenths of an inch, breadth less than one inch.

CORBULA.

1. C. *cuneata*. Pl. xiii. fig. 2. *Shell* transversely ovate-trigonal, acutely angulated or somewhat rostrated before, and depressed on the anterior slope, which is separated from the disk by a subacute line : *surface* of both valves similarly striate with equal, elevated, equidistant lines, forming grooves between them ; the striæ on the smaller valve are rather more distant : *umbones* not prominent.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

Length of the larger valve hardly more than the fourth of an inch, breadth more than two-fifths of an inch.

A very pretty species. It was imbedded in a mass which contained fragments of the large PERNA.

2. C. *inæquale.* Pl. xiii. fig. 3. Shell convex, transversely ovate-trigonal, rough, with unequal coarse wrinkles : *anterior margin* with a very acute but short rostrum at its inferior termination, separated from the disk by an acute line : *base* rounded and a little contracted near the anterior angle : *umbones* not prominent.

Length two-fifths, breadth rather more than half an inch.

This species has a different aspect from the preceding ; it is longer in proportion to its width, more convex, and the wrinkles, though prominent, are altogether destitute of that equality which distinguishes those of the other shell.

PANOPÆA, *Menard.*

P. *reflexa.* Pl. xiii. fig. 4. Exterior and interior views. *Shell* transversely oblong-subovate : *anterior margin* somewhat narrower and longer than the posterior margin, the edge reflected : *surface* wrinkled, and profoudly so towards the base.

Length three inches and two-fifths, breadth five inches and seven-tenths.

This fine shell approaches closely to the P. *fau-*

jas of Menard, which Lamarck seems inclined to consider as but a variety of the P. *glycimeris*, Gmel. Our shell is comparatively somewhat shorter than the latter, and its reflected anterior margin distinguishes it from the *faujas*.

SERPULA.

S. *granifera*. Pl. viii. fig. 4. Covered with longitudinal, contiguous, slightly elevated, granulated striæ.

DESCRIPTION. Shell subcylindric, contorted, inferior side flat ; the whole surface is composed of very numerous, small, contiguous striæ, each consisting of a single row of granules ; these series are alternately smaller.

Diameter of the larger end three-tenths, of the largest specimen two-fifths of an inch.

The continuity of the tube within, is interrupted by oblique diaphragms. It sometimes approaches the spiral form, and one specimen has three complete volutions of much regularity.

DENTALIUM.

D. *attenuatum*. Pl. viii. fig. 3. Arcuated ; surface marked with from twelve to sixteen rounded ribs, intervening grooves simple ; lines of growth numerous, distinct ; aperture orbicular.

Length nearly one inch and seven-tenths.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

The species of this genus are very closely allied to each other, and at the same time they exhibit so few characters, that it is with difficulty that some of them are determined. The present seems to differ from either of those already described. In the collection of the Academy are two fragments of DENTALIA very closely allied to this species, which were obtained by Mr. A. Jessup in New Jersey; but their imperfect state do not justify me in deciding upon a fact so important to geology as their specific identity.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1824.]

Plate VII.

EXPLANATION OF PLATE VII.

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Fig. 1.	*Turritella plebeia*	125,	**301.**
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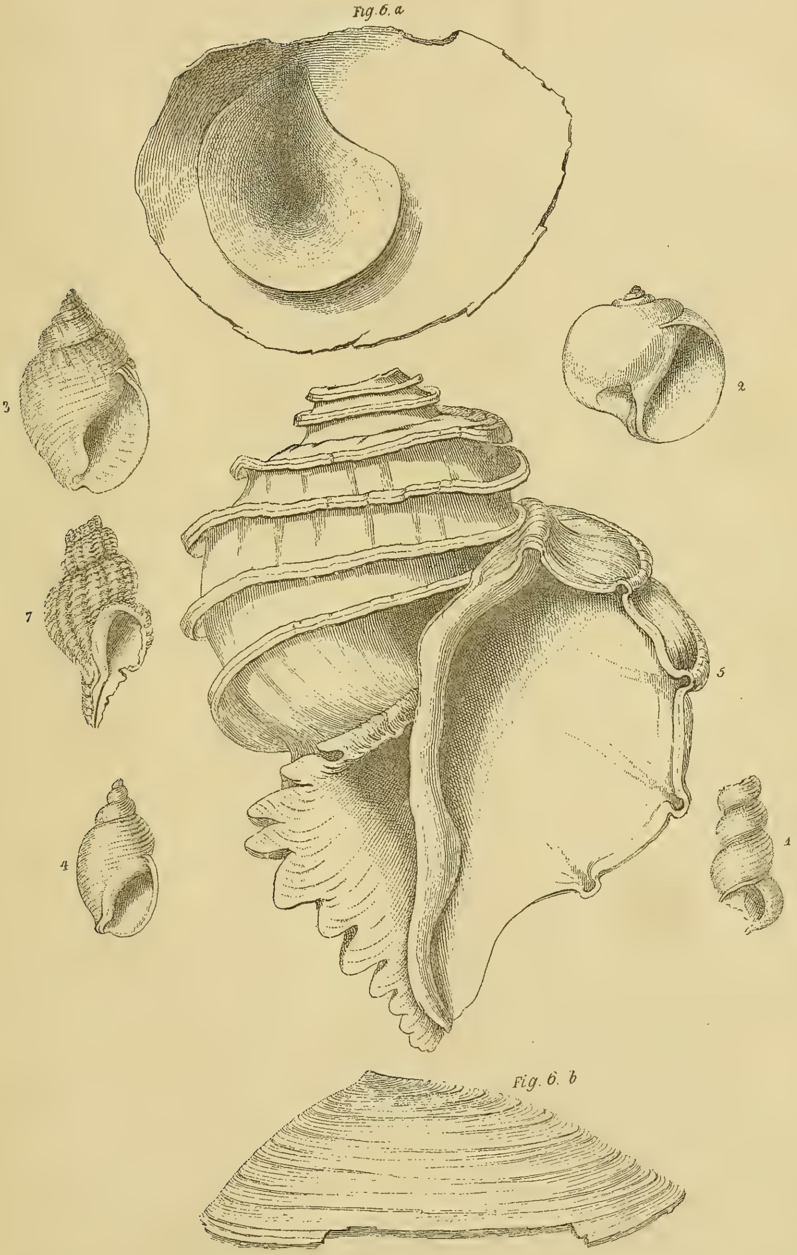
3.	*Buccinum porcinum*	126,	**302.**
4.	*Buccinum aratum*	127,	**303.**
5.	*Fusus 4-costatus*	"	"
6.	*Calyptræa grandis*	130,	**306.**

The type of the genus "*Dispotæa.*"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2
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5
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1
Fig. 6. b

Plate VIII.

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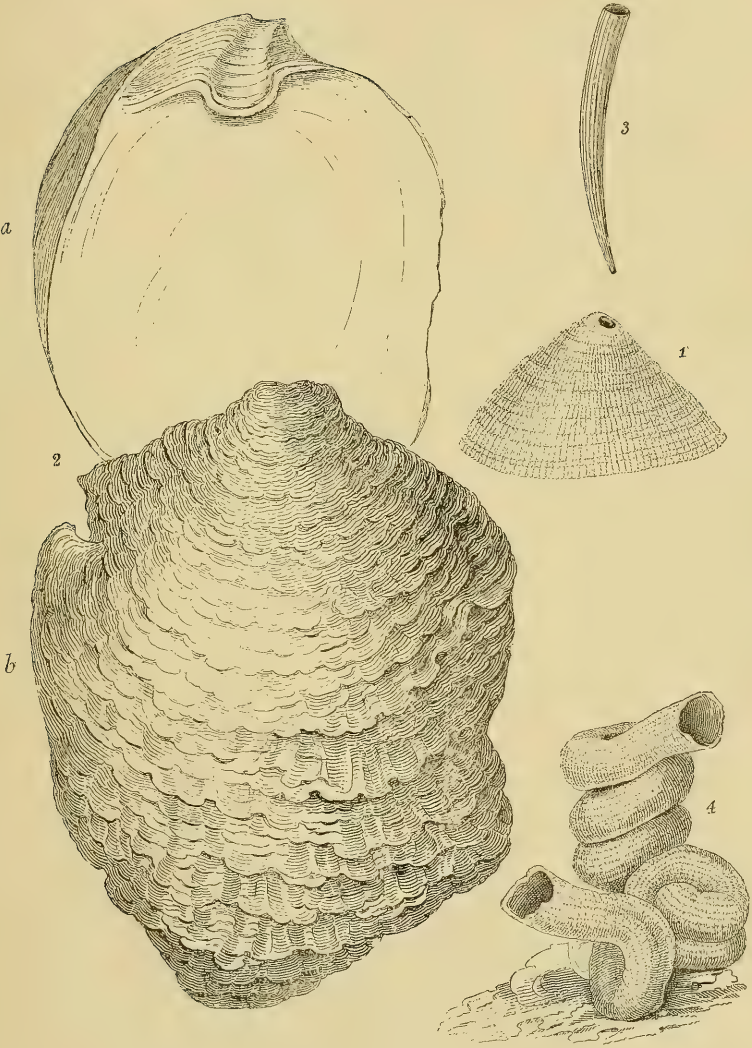
		Page.
Fig. 1.	*Fissurella redimicula*	132, **308.**
2.	*Ostrea compressirostra*	“ “
3.	*Dentalium attenuatum*	154, **330.**
4.	*Serpula granifera*	“ “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a
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b
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Plate IX.

EXPLANATION OF PLATE IX.

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3.	*Pecten septenarius*....................................	136, **312.**
4.	*Plicatula marginata*....................................	" "
5.	*Astarte undulata*....................................	150, **326.**
6.	*Astarte vicina*....................................	151, **327.**

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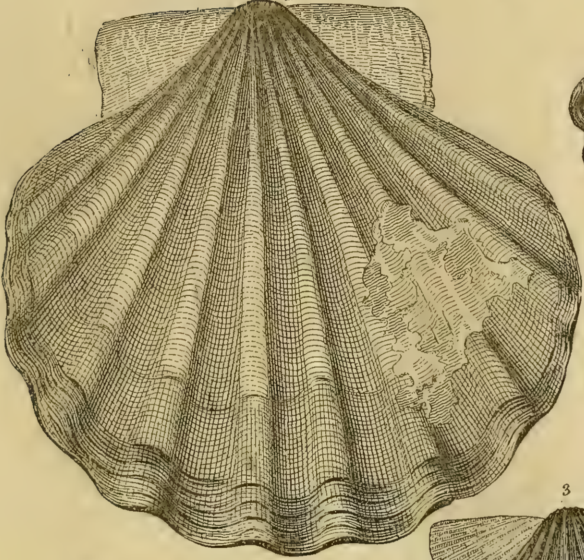

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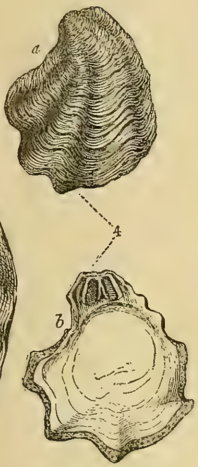

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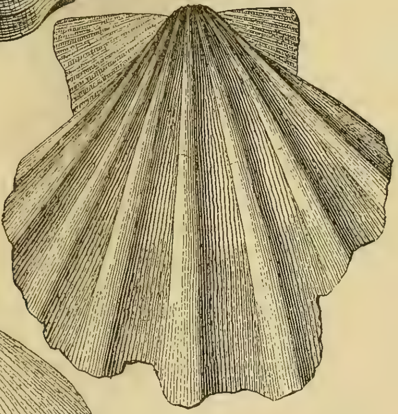

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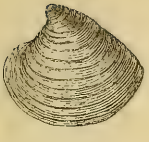

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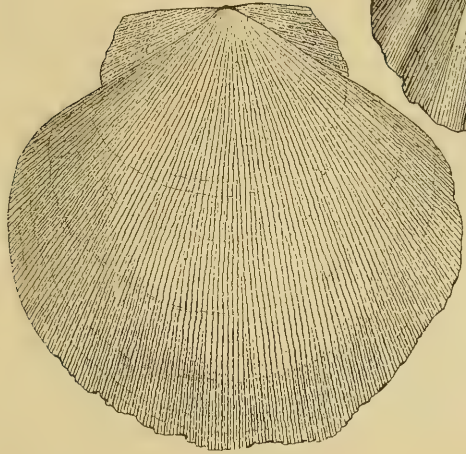

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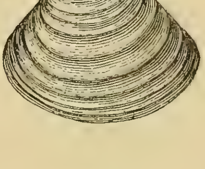

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EXPLANATION OF PLATE X.

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	5.	*Nucula lævis*	141, **317.**
	6.	*Nucula concentrica*	“ “
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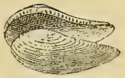
	8.	*Lucina contracta*	“ “
	9.	*Lucina anodonta*	146, **322.**
	10.	*Amphidesma subovata*	152, **328.**



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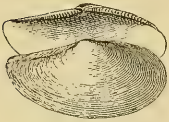

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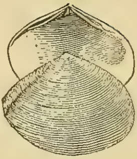

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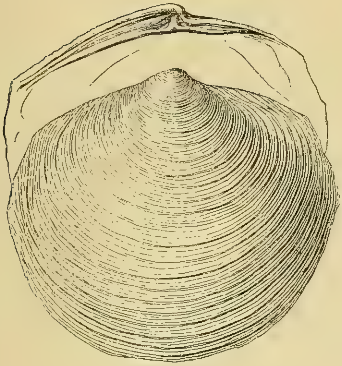

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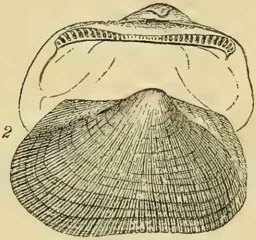

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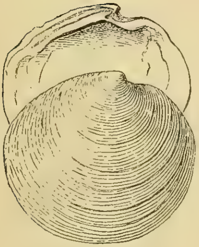

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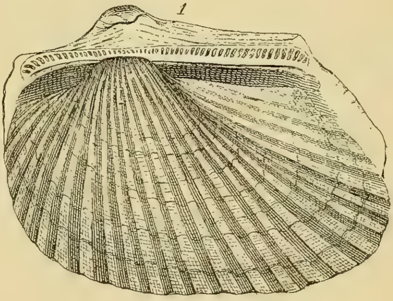

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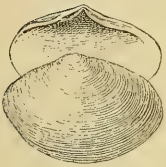

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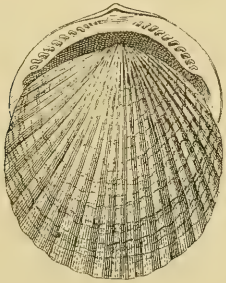
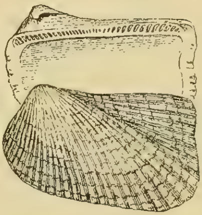




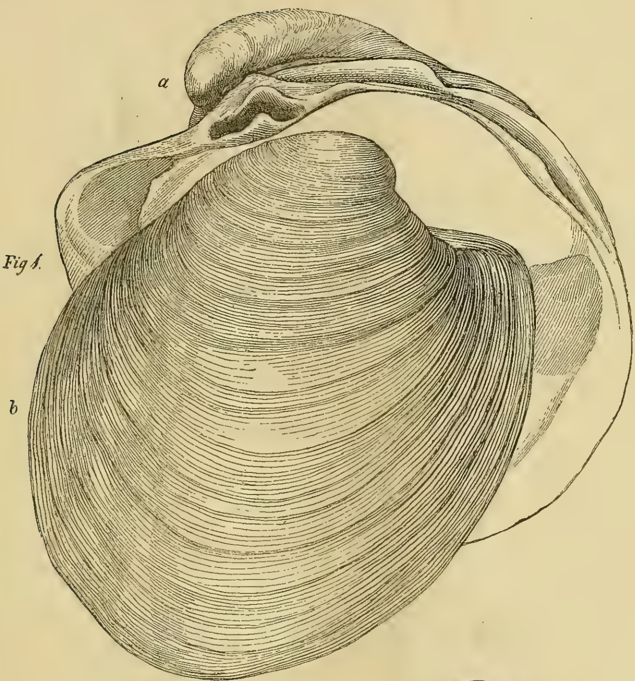
3

Plate XI.

EXPLANATION OF PLATE XI.

(30)

		Page.
Fig. 1.	*Isocardia fraterna*	143, **319.**
2.	*Crassatella undulata*	142, **318.**



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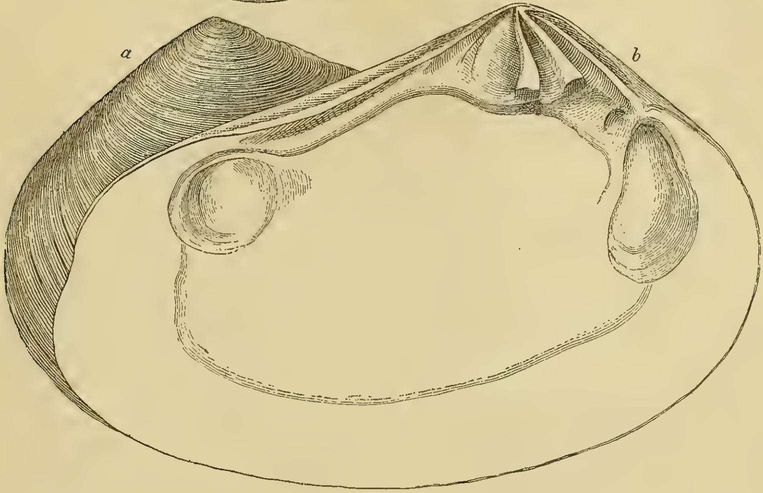


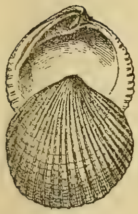
Fig 2

Plate XII.

EXPLANATION OF PLATE XII.

(**31**)

		Page.
Fig. 1.	*Venericardia granulata*	142, **318.**
2.	*Venus deformis*	148, **324.**
3.	*Cytherea convexa*	149, **325.**



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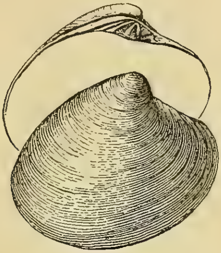

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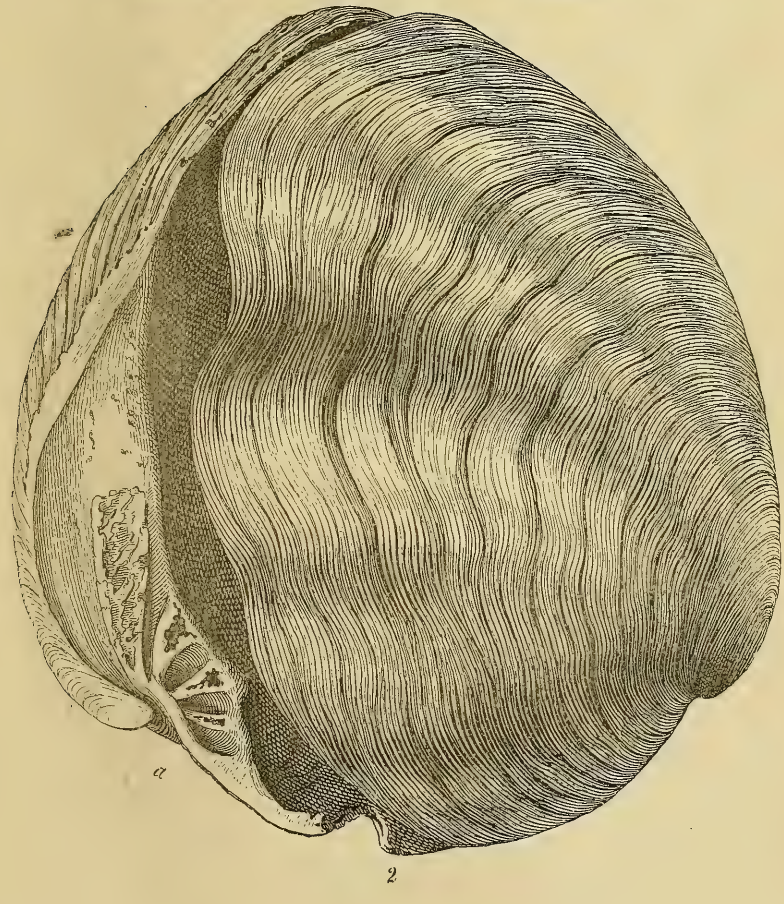

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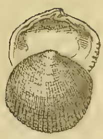
(**32**)

		Page.
Fig. 1.	*Lucina cribraria*	147, **323.**
2.	*Corbula cuneata* *	152, **328.**
3.	*Corbula inæquale*	153, **329.**
4.	*Panopæa reflexa*	“ “

* This and the following were numbered “3” in Say's original paper pp. 152 and 153.



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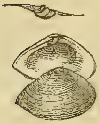

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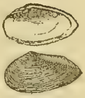

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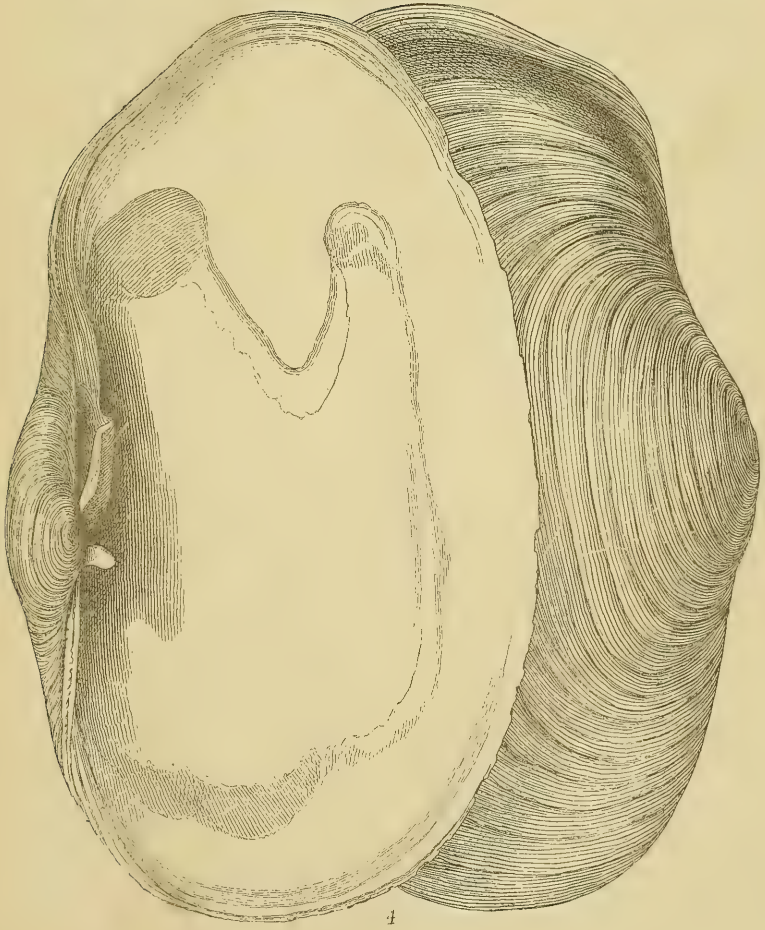

4

On two genera and several species of CRINOIDEA.

By THOMAS SAY. *Read March 1st*, 1825.

I am indebted to the politeness and liberality of Dr. J. Bigsby, for the opportunity of describing the very interesting animal remains which form the subject of the following new genus.

Family CRINOIDEA.

CARYOCRINITES.

Generic character. Column cylindrical, perforated by a tubular alimentary canal : *pelvis* formed of four plates ; costals six, supporting the scapulæ, from which the arms proceed.

In Miller's arrangement this genus will occupy a station in the division *Inarticulata*, between the genera CYATHOCRINITES & ACTINOCRINITES. It may be indicated by the following formula.

A. Pelvis of four plates.
A. Costal plates six.
a. Column not dilated.
o. Alimentary canal round.
§. Articulating surface of the columnar joints, radiated.
†. Auxiliary side arms cylindrical, and placed irregularly. *Genus* CARYOCRINITES.
1. Two of the costals hexagonal. *1st Sp. ornatus*.
2. One of the costals hexagonal. *2d Sp. loricatus*.

Species.

1. C. *ornatus*. Costals, four pentagonal and two hexagonal.

Column inserted into a cavity at the base of the pelvis : *pelvis* rather large ; two of the plates quadrangular, attenuated to the base, where they are truncated and a little recurved at the junction with the column ; disks, particularly towards the base, granulated, with a distinct elevated interrupted line ; two remaining plates pentangular, attenuated to the base, where they are truncated and a little recurved at the junction with the column ; disk with elevated granules, and with two elevated interrupted lines, extending to the terminal angles : *costals*, four pentagonal and two hexagonal, all with elevated interrupted lines, radiating from the centre to the angles, with a series of truncated granules on each side, and a few granules in the intervening spaces ; interscapulars, two hexagonal, situated immediately above the hexagonal costals : *scapulars* six pentagonal, the upper sides of which are more or less irregular by projecting a little between the scapulæ, all with prominent lines granulated, similar to those of the preceding : *arms* six : *capital plates* with a heptagonal one in the middle, surrounded by five hexagonal plates and two irregular ones at the mouth : *mouth* not prominent, situated on one side of the middle, a little within the line of the arms, closed by small valvular pieces, its inferior side resting on the superior angle of one of the scapulars.

Longitudinal diameter from three quarters to one inch and a half; transverse diameter from seven-tenths to one inch and two-fifths.

2. C. *loricatus.* Costals, five pentagonal, and one hexagonal.

Resembles the preceding, but there is only one hexagonal costal plate, and one interscapular plate.

Longitudinal diameter one inch and eleven-twentieths; transverse diameter one inch and three-tenths.

Dr. Bigsby obtained seven specimens of the *ornata* and one of the *loricata.* He informs me that "they are found loose in brown clay at the foot of the ravine at Lockport, in which the New-York canal mounts the parallel ridge of Lake Ontario. They are extremely numerous, but almost always worn and crushed. They are filled with the clay in which they are imbedded. They are from one-tenth to one-eighth of an inch thick in their parietes. The clay rests upon horizontal, black, conchiferous limestone, in which I found part of an *encrinital* stomach, bearing a close, if not perfect resemblance to the CARYOCRINITES described by Mr. Say."

In the second volume of Silliman's Journal, p. 36, I instituted a new genus for the truly singular animal *reliquium*, which Parkinson called *Ken-*

tucky Asterial fossil. I shall now proceed to correct the characters of that genus agreeably to the discoveries of the ingenious Miller, in this family, and to identify by name the species which I then indicated.

PENTREMITE.

Column cylindrical, perforated ; segments articulating by radiated surfaces, with cylindrical side arms at irregular intervals : *pelvis* of three unequal pieces, two pentagonal and one quadragonal : *scapulæ* large, very profoundly emarginate for the reception of the tips of the radiating ambulacræ, obliquely truncated at the extremities, each side, for the reception of one side of a subrhomboidal plate or interscapular : *ambulacræ* five, radiating from the summit, and terminating at the tips of the emarginations of the scapulæ ; each with a longitudinal, indented line, and numerous transverse striæ which terminate in a marginal series of pores, for the transmission of respiratory tubes : *summit* with five rounded openings (ovaries) and an angulated central one (mouth and anus.)

This singular genus is so remotely allied to any other hitherto discovered, that I do not think it can with propriety, be referred to any Family yet instituted. By its columnar support it is related to the Family Crinoidea, but the total absence of arms and hands excludes it from that very natural group. The superior termination, in which the ambulacræ, the rounded openings, and the central angulated one, are situated, has some affinity to the Family Echinidea, but the columnar support shows that it cannot be arranged there.

Having thus on its inferior portion a resemblance to the Crinoidea, and on its superior surface a decided analogy to the Echinidea, I think it may with propriety form an intermediate family, under the following name and characters.

Family BLASTOIDEA.

Column composed of numerous articulating segments, supporting at its summit a number of plates, so united as to form a calyciform body containing the vicera ; arms none ; branchiæ arranged in ambulacræ.

In a natural series these bodies constitute the link between the Crinoidea and the Echinidea, on the one hand, whilst on the other, the former is unquestionably, but not more obviously, connected with the Stelleridica, by the unequivocal intervention of Comatula and Marsupites. Of all the genera of Crinoidea, it is to PLATYCRINITES that PENTREMITE seems most closely related.

Species.

1. P. *globosa*. Body subglobular ; sutures with parallel impressed lines.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1825.]

Length one inch and one-fifth ; greatest breadth one inch and three-tenths.

DESCRIPTION. *Pelvis* deep saucer-shaped, convex ; longitudinal sutures without parallel lines of increment, but these are very obvious at the terminal margin : *scapulars* with the impressed lines of increment very obvious at base, and near the tip each side : *ambulacræ* with impressed lines equidistant between the central line and the lateral series of pores.

This large and fine species belongs to the Philadelphia Museum. It was brought from England by Mr. Reubens Peale, who understood that it was found in the vicinity of Bath. None of this species, I believe, has yet been found in America. The parallel lines of increment margining the sutures, distinguish this from the following species.

2. P. *pyriformis*. Body oblong, pelvis gradually attenuated.

Length from three quarters to one inch and a quarter.

This species is found in plenty in Kentucky, in the same localities, and intimately intermixed with the succeeding species ; it may be readily distinguished by the gradual attenuation of the pelvis and contiguous parts, from the tips of the emarginations of the scapulæ, to the origin of the column. The first specimen I saw, was dug up in a garden at Reading, and was sent to my brother, B. Say, under the name of "petrified althea bud."

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1825.]

3. P. *florealis*, Schloth. Pelvis terminating abruptly, nearly horizontal.

Length from seven-tenths to nearly half an inch.

SYNONYMES.

Kentucky Asterial Fossil, PARK. ORG. REM. v. 2, *pl.* 13.

ENCRINITES *florealis*, SCHLOTH. petrif. (as quoted by Miller.)

This is extremely abundant in many parts of Kentucky, and on the margins of the Mississippi in a few places. Near Huntsville they are very numerous, and on the surface of a fragment of rock, three inches long, by two and a quarter wide, sent to the Academy by Mr. Hazard, of that place, I have enumerated eighteen specimens of this species more or less entire, and two specimens of the preceding species. On another still smaller piece of rock are twenty-one specimens, all in alto-relievo, two of which are of the preceding species. On a third fragment of rock, thirty may be counted, and on a fourth upwards of fifty.

That these animals were pedunculated and fixed, there cannot be any doubt. We see at the base of the pelvis a small rounded surface, perforated in the centre for the passage of the alimentary canal, and on the outer margin are very short but distinct radii of elevated lines, evidently intended for articulation with the first joint of the column. The column itself is always found in fragments accompanying the body of the animal, but never attached to it.

[J. A. N. S., Phila., 1st Ser., Vol. IV, 1825.]

I think it highly probable that the branchial apparatus communicated with the surrounding fluid through the pores of the ambulacræ, by means of filamentous processes ; these may also have performed the office of tentacula in conveying the food to the mouth, which was, perhaps, provided with an exsertile proboscis ; or may we not rather suppose that the animal fed on the minute beings that abounded in the sea water, and that it obtained them in the manner of the ASCIDIA, and by taking them in with the water. The residuum of digestion appears to have been rejected through the mouth.

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Italicized words indicate important references.

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APPENDIX TO BULLETIN
No. 5

January, 1897.

PREFACE.

We publish herewith a few notes from Long's Expedition to the Rocky Mountains, or more accurately, "Account of an Expedition from Pittsburgh to the Rocky Mountains, Performed in the years 1819 and '20, by Order of the Hon. J. C. Calhoun, Sec'y of War: under the Command of Major Stephen H. Long. From the Notes of Major Long, Mr. T. Say, and Other Gentlemen of the Exploring Party. Compiled by Edwin James, Botanist and Geologist for the Expedition. In two Vols.—With an Atlas. Vol. I. Philadelphia: H. C. Carey and I. Lea, Chesnut St. 1823."

Thomas Say accompanied this party as zoologist and hence it is to be presumed that the following notes were mainly, if not wholly, from his observations. The compiler, Edwin James, states in the preliminary notice, page 1, that important contributions of entire passages from Major Long and Mr. Say, are recognized in various parts of the work, but he has not always been careful to indicate the place of their introduction. Again, some of the new species are credited directly to Say, as will be seen by consulting these notes. We therefore have no hesitation in publishing all these paleontological foot notes as Say's work, though their diction and orthography show the hand of the compiler. Only such portions of the main text of the work have been introduced here as tend to make the meaning of the paleontology more clear.

The attention of the present publisher was called to these notes by Mr. Weller of Chicago University.

G. D. HARRIS.

Ithaca, N. Y., Jan. 4th, 1896.

Between Loutre island and Cote Sans Dessein, compact limestone occurs, in horizontal strata, along the sides of the Missouri valley. It is of a bluish white colour, compact structure, and a somewhat conchoidal fracture, containing few organic remains. It alternates with sandstones, having a silicious cement.* * * * *

[*Foot note*, *page 84*].

* From Bay Charles hill, 4 miles below Hannibal, Missouri, we received, through Dr. Sommerville, several organic remains. Among them are the following :

Carbonate of Lime :

One specimen contains exclusive quantities of segments of the Encrinite of small diameter, from 1-4 of an inch down to minute.

Another specimen also with numerous small Encrinites has a very wide and short radiated Productus.

Another specimen a grayish chert, containing cavities formed by the solution and disappearance of encrinites, the parts of these which were originally hollow when in the state of carbonate of lime, being subsequently filled with chert, now show the nature of the fossil, being cylindrical cavities, with a solid centre and transverse partitions—the largest 3-10ths of an inch wide.

From Rector's hill, adjoining the village of Clarksville, Missouri, from Dr. Sommerville's collection :

A specimen of oolite—carbonate of lime.

It is composed of small spherical granules in contact with each other, which, in their fracture, exhibit rather a concentric tendency, with the appearance of a central nucleus ; but we could not perceive any decided evidences of former organization in them. Imbedded in the mass are a few columnar segments of encrinites, and a portion of a compressed bivalve, which, in the form of its radiating lines, resembles a pecten.

From Charboniere :

A specimen in argillaceous sandstone of a portion of a leaf like the Nelumbium—It is only the middle portion of the impression of the leaf that remains, being of an oval form of about five inches in greatest diameter, the rest being broken away ; the stalk has been broken off at the junction of the leaf.

Productus *spinosus*. SAY.

A small species of terebratula, in width two fifths, and in length more than seven-tenths of an inch—an internal cast—individuals very numerous, varying much in size, the smallest being about one-fifth of an inch wide.

From the Mammelles near St. Charles :

Productus : a portion of a valve, and smaller portion of the opposite valve of a remarkably large species, of which the proportions may have been not dissimilar to that of the Ency. Meth. pl. 244, fig. 5—the striæ are similar to those of that shell, except in being somewhat smaller, and the groove of one valve, and consequent elevation of the other, not so profound, less abrupt, and more angular in the middle, and

[*Foot note*, *page 85*].

far less prominent on the edge of the shell. It may justly be named *grandis*, as its hinge width was more than 3 1-2 inches.

[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

Horizontal strata of sandstone, and compact limestone, are disclosed in the cliffs on both sides the valley of the Missouri. These rocks contain numerous remains of Caryophilla, Productus, and Terebratulæ.*

[*Foot note, page 106*].

* From Fort Osage.

Productus spinosus. Say. Longitudinally and transversely subequally striated, the transverse striæ somewhat larger than the others; a few remote short spines, or acute tubercles, on the surface, arising from the longitudinal striæ.

Breadth an inch and a half; the striæ are somewhat indistinct—as in No. 5.

Productus incurvus. Say. Shell much compressed; hinge margin nearly rectilinear: surface of the valves longitudinally striated; convex valve longitudinally indented in the middle; the beak prominent and incurved at tip; opposite valve with a longitudinal prominence in the middle; the beak incurved into the hinge beneath the other beak and distant from it.

Width more than 2 2-5 inches—A few univalves also occurred, but they were so extremely imperfect that their genera could not be made out.

[*Foot note, page 107*].

A dark coloured carbonate of lime, containing small Terebratulæ like the T. ovata of Sowerby, but less than half as long.

No. 1.—A mass of carbonate of lime, containing segments of encrinites in small ossicula.

6.—A Caryophylla of a single star, about 4 inches long, of an irregularly transversely undulated surface, imperfect at each end, but seems to have been attached at base—Near the base it is bent at an angle of about 45 degrees.

Some small and young specimens of the Terebratula, like T. subundata of Sowerby.

Miliolites centralis—*Say.*

12. Astrea. A species of very minute alveoles. From the state of the petrifaction no radii are perceptible, so that the genus is not determinable.

Saltworks near Arrow Rock. Columnar segments of the Encrinus.

Inferior portion of the head of a Pentramea. *Say.*

Segments of the column of an oval encrinus, much narrower in the middle than the oval vertebra of an encrinite represented by Parkinson, Vol. 2, pl. 13, f. 40—resembling those of the genus *Platycrinites* of Miller.

[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

CHAPTER VIII.

Winter Cantonment near Council Bluff—Councils with the Otoes, Missouries, Ioways, Pawnees, &c.

The position selected for the establishment of winter quarters for the exploring party, was on the west bank of the Missouri, about half a mile above Fort Lisa, five miles below Council Bluff, and three miles above the mouth of Boyer's river. At this place we anchored on the 19th September, and in a few days, had made great progress in cutting timber, quarrying stone, and other preparations for the construction of quarters.

Cliffs of sparry limestone rise in the rear of the site we had selected, to an elevation of near three hundred feet.* At times of low water, strata of horizontal sandstone, are disclosed in the bed of the Missouri. These pass under and support the limestone. Both these strata probably extend in connexion, some distance to the west; but as they are deeply covered with soil, we could not accurately ascertain their boundary in that direction. On the map accompanying the second volume of this work, we have traced a line running from the Canadian river of the Arkansas, to the Elk Horn, between 96° and 98° west longitude, and marking what we supposed nearly the westernmost limit of the horizontal limestones, and the argillaceous sandstones, disclosed in the beds of the larger rivers.

Both these strata, embrace numerous relicks of marine animals, many of which we collected.†

[*Foot notes, page 146*].

* Height of the bluff ascertained by Lieut. Graham;

Trigonometrically, - - - -	271 feet.
Barometrically, - - - - -	277

† We add some notices of a few of the most important.

1. Terebratula.—A specimen considerably resembling the T. *subunda*-

[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

[*Foot note, page 147*].

ta of Sowerby, in the undulated line of the edges of the valves; but it is a much more depressed shell, and of a much less rounded form.

In the young state, the undulation of the edge is not very distinct, but this character increases with age, so that in the young state, it appears like a totally different species from the adult.

2. In the same rock are very numerous arquated spines, like ribs of fish, some of them 1 1-2 inches long.

3. A fragment of a Terebratula or Productus, imbedded, with very long spines, which may possibly be the same with the above.

4. A specimen being a mass of comminuted fragments of shells, amongst which are only recognizable a few segments of the column of the Encrinus, and minute turretted univalves of five whirls which resemble Turritella, and are about one-twentieth of an inch long.

5. Millepora *cylindrica. Say.* Branched, cylindric; *pores* very regular, alternate, oval, placed nearer to each other than the length of their own transverse diameters, and resembling those of an *Alveolite.*

Diameter, about one-tenth of an inch.

6. Segments of the column of Encrinus of authors, of a pentagonal form.

7. Ossiculæ of the body of a crinoid animal of the analogous species to No. 21.

8. Fragment of a Perna?

9. A mass of argillaceous sandstone, containing spines of a Linnæan Echinus, belonging probably to the genus Cidarites of Lamarck. Of these spines some are elongate-conic, others slightly fusiform, obtuse and slightly dilated near the tip, both are armed with short asperities throughout their length. They resemble in some degree those of the Cidarites *pistillaris* of Lamarck, but they are smaller, less fusiform, and the asperities are not so prominent.

In the same mass are fragments of Encrinus, and fragments of Retepore.

10. Retepore, much resembling the Milleporites *flustriformis* of Martin, Petrif. Derbi. pl. 43, fig. 1 and 2., but the alveoles in our specimens are rather smaller.

11. Millepora *cylindrica. Say.* Of the diameter of half an inch.

12. Productus *subserratus. Say.* Shell transvere, convex valve semicircular, destitute of asperities or striæ, longitudinally indented in the middle; line of the hinge rectilinear, half as long again as the length of the shell, with three or four spines or serratures on each side towards the angle; *umbo* not prominent, the beak hardly prominent beyond the line of the hinge. Length, more than three-tenths; breadth, more than one half an inch. A large specimen was four-fifths of an inch wide.

If we except the beak, the outline of this shell as respects the hinge margin and the sides, considerably resembles that of P. *spinulosus* of Sowerby, but the base is far more obtusely rounded, and it is a shorter shell comparatively with its width. The serratures are very often broken off.

[*Foot note, page 148*].

The curvature of the sides, does not in the slightest degree project beyond the angles of the hinge line.

13. An imperfect cast, very like the Terebratula *subundata* of Sowerby, and of equal magnitude.

[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

14. Pentagonal ossiculæ of the trunk of Encrinus of authors, which in outline, may be compared to figs. 61 and 62, of plate 13, vol. 2, of Parkinson's Organic Remains, but their surfaces do not now exhibit any sculpture.

Many of these shells exhibit the most unequivocal evidences of having been in a plastic state, at some period or other, since their deposition in their present situations. The fine striæ of a Productus *lineolatus*, are so interlaced on the middle of a valve of one of our specimens, as at once to convince every observer, of the shell having been thus partially dissolved, and when in this state, to have been gently rubbed by some other body, in two directions proceeding obliquely to the same point, so as to throw the striæ in that part, entirely out of their proper longitudinal direction. It is very common to find shells, unnaturally flattened or compressed in various ways and degrees, often without any fracture in the shell or cast; a circumstance which certainly could never happen to the shell, unless it was in a plastic state, or in a state of partial solution.

16. A specimen of carbonate of lime, on its surface a mass of sub-parallel tubes, connected by short lateral processes. The whole much resembles, and is probably congeneric with the Erismatholithus tubiporites, (*catenatus*) of Martin's Petrif. Derbi. t. 42, fig. 2, but the connecting processes of the tubes, are much shorter than they are represented in that figure; but it correspouds much more exactly with the tubiporite, figured by Parkinson in his *Organic Remains*, vol. 2, pl. 1, f. 1., and may with great propriety, form a new gènus, the type of which will be the Tubipora Strues of Lin.

The genus is probably allied to Favosites and Tubipora.

17. Trilobus. The abdomen of a species of this singular genus, frequently occurs in the sandetone of the Missouri; near Engineer Cantonment they are very common. The largest was rather more than one inch long, by about 1 3-10 inches in breadth at base, but the more general length is about three-fourths of an inch. The tergum or intermediate lobe is narrow, being not more than two-thirds of the width of the flanks, and much more convex than those parts.

But a single specimen occurred which we can, without any doubt, consider as the thorax of a Trilobus; but whether or not it appertains to the same species with the above, or to some other of which we have no other fragment, we are at a lòss to determine. Like the abovementioned abdomen, it is distinct from any that we have seen figures of. It is of a narrow lunate form, highly convex, the disk destitute of sculpture, and the eyes prominent.

18. Many imperfect casts of two different kinds of bivalve shells occur near Engineer Cantonment, of which one may possibly have been a *Cardita*.

[*Foot note, page 149*].

19. Tooth of a Squalus, which seems to approach nearest to those of *Sq. maximus*, by its compressed conic form.

Greatest length 2 1-10 inches.

Thickness more than 2-5 of an inch.

The sides are rounded, without any appearance of serratures; thickened near the tip, and more compressed near the base.

20. Tooth of a Squalus, something like that of *S. galeus*, but less of a triangular form, and the lateral processes are more distinct, and also less triangular than in that species.

[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

21. An imperfect body of a crinoid animal, *Encrinite* of Authors; the fragment is about one half of the inferior portion of the body, from which the following description is made out, taking into view the whole circumference. The plates composing the *first costal* series, (Miller) five in number, are longitudinally pentangular, much curved inwards towards the base to join the *first columar joint*, or perhaps the *pelvis;* at which part the plate is narrow, being about one-ninth of an inch, whilst the other sides are nearly three-tenths of an inch each, the superior ones being somewhat longer than the others; the *second costal plates*, (Miller) five in number, are transversely pentangular, the superior joint being long, the lateral ones shortest, the former being one-half an inch in length, the latter 3-20, and the inferior sides which articulate to the segments of the pelvis, somewhat less than 3-10 of an inch; the margins of the first costal joints, as well as the superior margins of the segments of the pelvis, are armed with a few tubercles, some of which seem to have been perforated; all the superior pieces are wanting in our specimen, but the truncated surface, on which the *scapulars* (Miller) rested, is of a pentagonal outline, and composed of a series of horizontal equilateral triangles, two to each side, which are separated on each side from the adjacent pairs by a deep groove, which corresponds, and is nearly at right angles with the exterior sutures, which join the first costal joints to each other; these triangular surfaces, are also separated from the exterior edge by two grooves, which are crenated, and inclose an oblong foramina between them; a single *intercostal plate* occurs, interposed between two of the *second costals*, it is of an oblong hexagonal form, its base resting upon the extremity of a segment of the *first costals*, which is truncated to receive it, the superior portion of this plate is much bent inward towards the abdominal cavity, its tip is quadrate and concave.

The whole exterior surface of this reliquium, with the exception of the tubercles, and sutural impressed lines, is plain and equable.

If we have not mistaken the pieces of this imperfect specimen the pelvis is wanting, but the cavity in which it existed, must have been about 3-20 of an inch in diameter.

The plate-like form of the ossicula, and their mode of articulation with each other, by an extension horizontally inwards, as we have described above, in the case of those plates which we have considered as the *second costals*, seem to indicate, that this species ought to be referred to the se-

[*Foot note*, *page 150*].

cond division of the Crinoidea, or *Semiarticulata* of Miller. It certainly, however, cannot be at all referred to Poteriocrinites, the only genus which that author has framed in the division of the family. We refrain from distinguishing it by a name either generic or specific, until other specimens can be obtained, in which the characters are less equivocal.

We have two *second costal plates*, which made part of distinct individuals, larger than the above described one. Of these the surface of one is perfectly glabrous, whilst that of the other has light orbicular indentation instead of tubercles; a third very small one is perfectly smooth like the first, and doubtless formed part of the body of a young individual.

Another plate found near the same spot with the above, is of a somewhat triangular form exteriorly, or rather like the face of a truncated pyramid, of which the middle of the summit is a little produced in the form of a right angle, thus offering a scollop on each side of the apex for the adaptation of superior ossiculæ. On divesting it carefully of its extraneous matrix, we discovered that it was readily adjusted by its base to the

[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

summit of those segments of the fragment above described, which we have supposed to be *second costals*, a prominent line on its base corresponding with the inner one of those grooves which we have described, to characterize the superior face of those plates. This plate then, agreeably to the relations in which we have viewed the preceding pieces, must be a *scapula;* it is susceptible of considerable hinge-like motion, and appears to have been much less firmly attached to the costals than the latter are to each other.

A segment of a crinoid animal, which seems to have been a *first costal joint* of a *Pentacrinus* of Parkinson, occurred near the same place.

22. Productus *pectenoides. Say.* Convex valve, with a central longitudinal indentation; the whole surface is longitudinally ribbed, each rib being marked by two striæ, in addition to the central carina.

The shell is not of frequent occurrence, and a perfect specimen has not yet been obtained, but the portions we have examined, are sufficient to show that it is perfectly distinct from either of the species we have mentioned. We do not find any species figured or described by authors, like it.

23. *Productus compressus. Say.* Shell much compressed, with numerous, acute striæ, upwards of fifty in number on each valve, the alternate ones rather smaller; a very slight central longitudinal indentation, on the convex valve; outline suborbicular; hinge edge rectilinear, shorter than the greatest breadth of the shell.

Greatest breadth, from 3-5 to 1 inch. In its proportions it resembles the truncated portion of the productus of Martin, as represented on his plate 22, fig. 3. It is very common.

24. A shell of the length and breadth of three inches sometimes occurs, the convex valve of which is transversely undulated, its umbo prominent, and curved like that of a Gryphæa, its tip resting on the base of the opposite valve, which is concave, with a transverse linear base; its muscular impressions seem to have been lateral.

[*Foot note, page 151*].

25. A single specimen was found of a valve of a shell, in some degree resembling a pecten, but without the auricles. Length, more than 2 3-10 inches.

26. Productus *lineolatus. Say.* Valves with numerous, fine, equal, equidistant, longitudinal striæ, and a few small tubercles; convex valve very much elongate, its basal portion is curved downwards, almost perpendicularly with respect to the disk near the umbones.

So singular is the structure of this shell, that the internal cavity appears to have been perfectly transverse, with respect to the general length of the shell, and small in comparison with the length. It strongly resembles the Anomites productus of Martin, as represented on plate 22, fig. 102, of his Petrif. Derbi., and like that shell it is armed with small tubercles, though fewer in number, and the striæ are much more numerous and smaller.

27. Cast of a turretted univalve, probably a Cerithium, of the length of 2 1-2 inches.

28. Cast of the anterior portion of a valve of a shell like an Ostrea, of the breadth of 2 1-2 inches.

29. On the Missouri near the Platte, occur masses of rock, which seem to be almost exclusively composed of a remarkable petrifaction, belonging to the family of concamerated shells. This shell is elongated, fusiform, and when broken transversely, it exhibits the appearance of numerous

[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

cells disposed spirally as in the *Nummulite*, but its longitudinal section displays only deep grooves. The shell was therefore composed of tubes or syphons, placed parallel to each other, and revolving laterally as in the genus *Melonis* of Lamarck, with which its characters undoubtedly correspond. But as in the transverse fracture, its spiral system of tubes cannot be traced to the centre in any of the numerous specimens we have examined, it would seem to have a solid axis, and consequently belongs to that division of the genus, that Montfort regards as distinct, under the name of *Miliolites*, which seems to be similar to the *Fasciolites* of Parkinson, and altogether different from the Miliolites of Lamarck. Our specimens are conspicuously striated on the exterior, which distinction, together with their elongated fusiform shape, sufficiently distinguish them as a species from the *sabulosus*, which Montfort describes as the type of his genus. No aperture is discoverable in this shell, but the termination of the exterior volution, very much resembles an aperture as long as the shell.

The length is three-tenths of an inch. And its greatest breadth, one-twelfth.

We call it *Miliolites secalicus. Say.* Mr. T. Nutall informs me, that he oserved it in great quantities high up the Missouri.

In the same mass were some segments of the Encrinus, and a Terebratula with five or six obtuse longitudinal waves.

30. Another petrifaction, abundant in some fragments of compact carbonate of lime, also found on the shores of the Missouri, possesses all the generic characters, which we have attributed to the preceding species, excepting that in the transverse fracture, the cells distinctly revolve from the centre itself, and of course the shell was destitute of the solid nucleus as in Melonis. *Lamarck.* It has about four volutions. We have named this species, which is, notwithstanding the difference of the central portion, of the same genus with the preceding, *Miliolites centralis. Say.* As in the preceding, it is entirely filled solidly with carbonate of lime, and this substance being of a greater purity in the filled up cavities of the fossil, than in the mass, its interior divisions are very obvious.

[*Foot note, page 152*].

The latter species, we observed about one hundred miles up the Konzas river, where it forms the chief body of the rocks in extensive ranges. It seems to be a carbonate of lime containing iron.

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[Long's Expedition to the Rocky Mountains, Vol. I, 1823].

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